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International Journal of Orthodontia and Oral Surgery

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Vol. 22, No. 8, August, 1936. International Journal of Orthodontia and Oral Surgery is published by The C. V. Mosby Company, 3523 Pine Blvd., St. Louis, Mo. Subscription Price: United States, its Possessions, Pan-American Countries, $7.00; Canada, $7.50; Foreign, $8.50. Entered as Second-Class Matter at Post Office at St. Louis, Mo., Under Act of March 3, 1879.

International
Journal of Orthodontia
and Oral Surgery

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VOL. 22 AUGUST, 1936 No. 8

Orthodontia

PRESIDENT'S ADDRESS

SOUTHERN SOCIETY OF ORTHODONTISTS*

WINSTON P. CAINE, D.D.S., CHATTANOOGA, TENN.

FIRST, I wish to thank you for the honor that you have bestowed upon me by electing me president of this Society and to assure you that I deeply cherish the honor and appreciate the confidence that you have given me.

The success of any meeting is due to the good work of the committees in charge of its program and arrangements. The Program Committee has been untiring in its efforts to give a good program, and I wish to thank this committee for the splendid work that its members have done in arranging the program. I wish also to thank the members of the Local Arrangements Committee for attending to and arranging all the local details.

The more closely I come in contact with the details of organization of a society of this kind, the more I admire and respect the charter members of the Southern Society of Orthodontists, who organized this Society in 1921. There were nine charter members who met in Atlanta on February 23, 1921, at the Piedmont Hotel and there formulated the plans of the Society to which they gave the name that it now bears. I am going to read the names of those charter members, and I hope that they are all here with us today:

Clinton C. Howard
J. A. Gorman
Oren A. Oliver
W. B. Childs
Carroll C. Johnson
Thomas T. Moore, Jr.
Donald Morrison
Thad Morrison
Harle L. Parks

William C. Fisher was an honorary charter member.

*Fourteenth annual meeting held January 27, 1936, at Chattanooga, Tenn.

The first officers elected by the Society were:

Clinton C. Howard, president.
J. A. Gorman, vice-president.
Oren A. Oliver, secretary and treasurer.

The first regular meeting of the Society was held in Atlanta, Georgia, March 14, 1922. Dr. John V. Mershon appeared on the program and read a paper entitled "Physiology and Mechanics in Orthodontia" and gave a clinic on the uses of labial and lingual arches with various finger springs.

At the last meeting of the Society it was the plan of the Program Committee to have most of the essays devoted to the biologic and etiologic sides of orthodontia. That meeting was held in Hot Springs, Virginia, and was a most excellent and successful meeting in every way. The Program Committee for this meeting has planned to have most of the essays devoted to the treatment or practical side of orthodontia, so that taking the two meetings together a view of both sides of orthodontia will be presented to our members. I believe that our Program Committee has shown fine judgment in securing the men to be with us and make up the program. Most of them have come a long way and have left busy practices to do us the honor of meeting with us. On behalf of our membership and for myself personally, I wish to express to them our thanks and our appreciation of their part in the program.

For the last several years business of all kinds has been in a condition of unrest and uncertainty. Practically all the professions have suffered greatly. The number of men engaged in some lines of work has been greatly reduced, and many men have been forced to seek employment in lines other than their own. Throughout the depression, orthodontia has carried on, signifying that it has a definite need and a work to do.

The medical profession has a term "elective treatment," as opposed to "emergency treatment," which it uses to apply to certain types of cases in which the time of treatment may be elected or selected by the patient himself. I think that this term could also be applied more or less accurately to cases of orthodontia. During the last few years a large number of cases of orthodontia have of necessity been postponed on account of financial conditions.

In most sections of the country we feel that the depression is about over, and what is true of one section is more or less true of other sections. Now that the depression is about over and the economic condition of the country is returning to normal, I feel most optimistic about the future, and I predict that orthodontia and dentistry will enjoy a most favorable era.

There is a changing order of things in the entire country. Some parts of the old order have gone—possibly never to return. Rather than be reactionary, I think it behooves us as professional and thinking men to line up with the forward movement of affairs and to use our influence and judgment to assist and direct in the formulating of the laws and policies that will affect our great profession—dentistry. I make this reference on account of the fact that legislation probably will be presented in the future in Congress or in the individual states under the heading of so-called "social security," designed as "health security" or "health conservation" measures, that will affect the medical and dental professions.

Unified organization is the basis of most successes where there is involved a large number of individuals—whether it be an army, a big business, or a profession. It seems to me that we as orthodontists and with orthodontia as our profession will be benefited by a plan of closer cooperation between our district or sectional societies and our parent organization, which is the American Society of Orthodontists.

From an orthodontic standpoint, our essays, case reports, and clinics will speak for themselves. I feel that the talent represented on our program is among the best in present-day orthodontia. The ideas that these men bring to you are methods and procedures that have successfully accomplished definite results in their hands. It sometimes happens that all of us do not agree with the methods and technics that are given at an orthodontic meeting, but we must remember that "when all men agree there is no progress." If all orthodontists had agreed years ago, the last word would have been written in orthodontia, nothing would have been changed, there would have been no improvement. The last word has not been written in orthodontia, and the last word will never be written as long as there is room for improvement. The science of orthodontia is a building process. One generation stands and builds upon the shoulders of the former, retaining the ideas that have been worked out and proved successful and discarding those that have been tried and found unsuccessful. To this storehouse of knowledge and information are added the new discoveries of the present.

There are in orthodontia today a number of phases calling for careful thought and investigation. In this paper I shall refer to only one and that is "time of treatment." To me this is one of our important problems and one upon which all of us do not agree. By that, I mean that all of us might treat a case and obtain a pleasing and successful result, yet all of us might not agree as to when would be the best or most advantageous time to begin the treatment of the case in question. I believe we all agree that there are certain types of malocclusion in young patients that would require immediate treatment as soon as presented, regardless of the age. There are other types of malocclusion, however, about which all of us would not agree as to when treatment should be started. I think this question of "time of treatment" is one that deserves our careful study and consideration.

BILATERAL MESIOCLUSION WITH LINGUOVERSION OF RIGHT MAXILLA, WITH LEFT CUSPID OCCLUDING WITH THE MANDIBULAR FIRST MOLAR. MUTILATED CASE

HARLE L. PARKS, D.D.S., ATLANTA, GA.

HISTORY.—The patient, a young lady twenty-one years old, appeared for treatment with the following history: voice impaired, vision good, hearing good, height 5 feet 2 inches, weight 113 pounds, nose and throat in good condition, general health good. Facial form—mandible to the right and protruding, narrow receding maxilla. Left maxillary cuspid occluding with left mandibular first molar. Father and mother have normal teeth; neither had received orthodontic treatment. Father and mother have good facial form. Patient has never had any serious illness. Adenoids and tonsils removed. During infancy patient was breast fed, began walking at one year of age; permanent teeth appeared at six years of age. Lip habit.

Attributed Etiology.—Unknown. Possibly a lick from a baseball had some bearing on the case.

Diagnosis.—Bilateral mesioclusion with linguoversion of right maxilla, with left cuspid occluding with the mandibular first molar.

Treatment.—X-ray examination revealed left mandibular first molar abscessed; this was extracted. The rest of the mouth was in good healthy condition. The following teeth were extracted before the patient presented for treatment: right first mandibular molar, left maxillary second bicuspid, and first molar.

Fig. 1 shows front and lateral views of models of case when started. Fig. 2 shows front view of patient with chin pointing to right side. Fig. 3 shows teeth in occlusion. Fig. 4 shows right side with enlarged muscular condition in the mandibular region, presenting practically a straight angle of the jaw. Fig. 5 shows left view presenting a practically straight angle of the mandible.

Appliances used in step number one: Mandibular appliances consisted of bands on both the second and the third molars attached. Buccal tubes on the second molars carrying 0.040 wire extending mesially to the first bicuspids, with a ribbon arch bar uniting the two ends, having loops made of 0.022 wire in front of the buccal tubes. Bracket bands were placed on the six mandibular anterior teeth with brackets turned upside down. Hooks were placed on the appliances for intermaxillary rubbers. An 0.040 lingual appliance was constructed to rest away from the gingival margin of the anterior teeth, with spurs coming up and resting on the lingual occlusal surface of the anterior teeth. This appliance was used for uprighting the right mandibular second and third molars.

Presented before the Southern Society of Orthodontists, Chattanooga, Tenn., January 27-29, 1936.

Maxillary appliances consisted of a band on the first right molar and a band on left second molar with buccal hooks attached for intermaxillary force, lingual

Fig. 1.

Fig. 2. Fig. 3.

Fig. 4. Fig. 5.

appliances with right side extending back with an occlusal rest on the second molar, the left side extending back to the third molar with occlusal rest.

Recurved finger spring extending forward to central incisor on the right. On the left side a recurved finger spring, extending to incisor, with a loop wire

mesial to posts extending forward to second bicuspid with a wrap around the body wire extending buccally to engage the first bicuspid. Expansion was created carrying out the right central incisor, lateral incisor, cuspid, and bicuspids, then adjusting the body wire to bring the molars out in line with the other teeth. On the left side there was a small amount of expansion, by opening the loop wire carrying the anterior teeth forward.

Mandibular treatment consisted of closing the loop wire to close the spaces of the first molars. At the same time expanding the anterior teeth, with lingual appliances made of 0.040 wire by means of a twist being placed just mesial to the molars, I was able to upright the second and third molars. Intermaxillary force was used at all times. This type of treatment was carried on until the right maxillary first and second molars were brought into occlusion with the mandibular second and third molars. The mandibular molar spaces were practically closed.

At this time the ribbon arch and bracket bands were removed from the mandibular anterior teeth, and a plain labial arch bar was placed with loop wires in front of the tubes and hooks for intermaxillary force. The uprighting of the mandibular molars caused an open-bite condition.

Step number two in treatment: A skull and a chin cap were made of felt padding. This was cut and made to fit the hand and chin and was fastened with adhesive tape. Hooks were sewed on bias tape, which was fastened to the skull and chin cap, for carrying large rubber bands. These bands placed considerable force on the molars, helping them to depress.

The maxillary appliance was reconstructed placing a high labial appliance with J finger springs engaged in tubes on the left cuspid, central incisors, and right cuspid, rotating and uprighting these teeth. The left first bicuspid carried the anchor band for appliances. Intermaxillary force was used, and on the left side two bands were worn, one engaged to the second molar and the other to the first bicuspid; the one to the first bicuspid carried the anterior portion forward, and the one to the second molar closed the space of the first molar and the second bicuspid.

At the same time, closing the space from the loss of the left first mandibular molar was completed. At the time the molar space was closed in the mandible the patient was given a long rest period with a vulcanite retainer on the maxilla covering the entire palate, with a tooth in the space of the first molar.

Step number three in treatment: Maxillary—a lingual appliance with a band on the right first molar with a buccal hook and a band on the left first bicuspid with a hook on the buccal for intermaxillary force. Recurved finger springs for expanding the anterior portion. Band on left first molar with hook for intermaxillary force. Mandibular—both second and third molars were banded with bands soldered together. Plain arch bar with loop wires in front of tubes, with hooks for intermaxillary force. The arch bar was ligated to all teeth. Intermaxillary force was applied. This has brought the maxillary anterior teeth almost into an end-to-end occlusion, but the median line remained

slightly shifted to the right side. This type of treatment was employed until the left maxillary teeth were in occlusion, the median line still to the right.

Step number four in treatment: Molar bands were placed on the maxillary first and second molars. A buccal bite plane was cast and soldered to the maxillary molar bands which engaged the buccal surface of the right mandibular molars and established the median line in its proper relation. The same type of appliances and treatment is being employed at present as was used in step three.

Results Achieved.—Fig. 6 shows front and lateral views of the case at present. Fig. 7 shows front view of patient at present. Fig. 8 shows occlusal view at present. Fig. 9 shows right view at present.

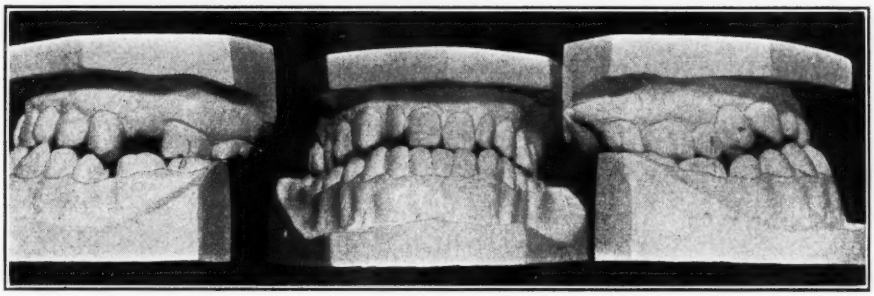

Fig. 6.

Fig. 7. Fig. 8. Fig. 9.

I feel very fortunate to have achieved such good results because the patient was out of the city a great part of the time and was away from three to six months at close intervals.

Prognosis.—When this case is complete, in my opinion, a practically normal facial balance will have been established, and, when the restorative work is completed, I believe this case will remain in proper relation. The patient is contemplating oral surgery to remove the sharp point from the chin to give it a more rounded appearance. At some future time I hope to have the privilege of showing the completed case.

REPORT OF A CLASS I CASE WHICH DURING AND AFTER TREATMENT DEVELOPED INTO A PRONOUNCED CLASS III MALOCCLUSION DUE PROBABLY TO AN ENDOCRINE IMBALANCE*

HARRY E. KELSEY, D.D.S., F.A.C.D., BALTIMORE, MD.

TREATMENT was started in April, 1919. The history of the case taken at that time is: "Class I malocclusion. Maxillary arch is narrow, the molars being in lingual occlusion. Mandibular second premolars appear to be impacted or absent, x-ray pictures being required to determine this. The alignment of the mandibular arch is otherwise good, as is also the quality of the teeth. Sucked thumb until seven years old. At two years of age, adenoids were removed and tonsils clipped (which as usual gave no relief so far as the tonsils were concerned). Was a mouth breather and could not pronounce the letter M. Now sleeps with mouth closed, but keeps it open part of the time during the day. Nose and nasal passages are fairly normal externally with apparently adequate breathing space. Has had measles, whooping cough, and chickenpox. No serious illness. Slight malocclusion in both parents. Wore glasses for a short time. Eats too fast. General development is normal."

Fig. 1 shows full face and profile views of the patient at the beginning of treatment. Fig. 2 shows front and profile views of models at the beginning of treatment. Fig. 3 shows x-ray pictures taken in 1920; both mandibular second premolars are missing; the very carious left one was extracted.

Treatment and retention were concluded at the end of about five years. It was a struggle during treatment to keep ahead of the rapidly growing mandible, notwithstanding the fact that both mandibular second premolars were missing. I am mortified not to have had casts made of the case at that time, but I can say from memory that the bite of the incisors was about edge to edge, and in general appearance (though not presenting normal occlusion) it was nevertheless quite a good-looking denture with fairly good masticating function. However, it slowly progressed into a pronounced prognathism. The patient was away at school most of the time, and not very accessible; besides he needed a rest, and I was getting suspicious as to the etiology of the case.

In August, 1927, I secured impressions, which show fairly well the progressively increasing size of the mandible. The maxillary molars were again in lingual occlusion on the left side, and the mandible was assuming that massive appearance accompanied by a straightening out of the angle which is characteristic of this type of case. The protrusion of the mandible and of the teeth in it was more noticeable when the casts were examined than is shown in Fig. 4, but still much less pronounced than was shown a year later.

*Read before the Southern Society of Orthodontists at Chattanooga, Tenn., January 27, 28, 29, 1936.

I called the attention of the patient's mother to conditions at this time and wanted to do some further treatment, but the patient was going away to college and it was deferred. Had it been possible for the patient to have further treatment at that time, I should have made it plain to him that it was experimental and was actuated by my desire to leave nothing undone which might possibly prove of benefit, although I myself was not sanguine of success.

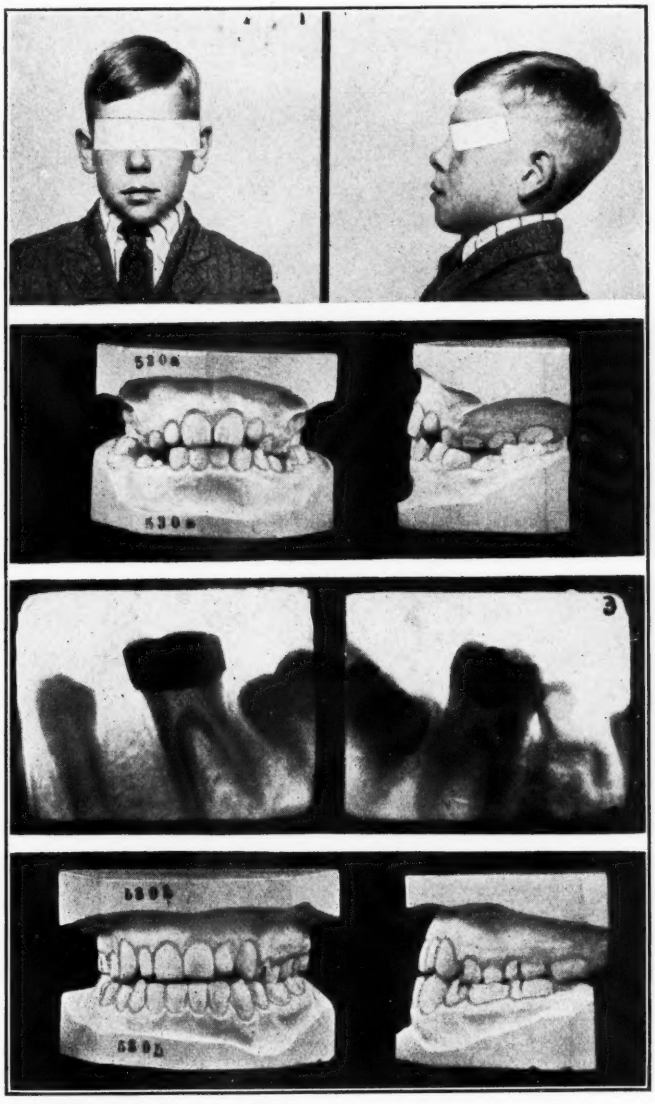

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 1.—Full face and profile of patient at beginning of treatment.
Fig. 2.—Front and side views of models at beginning of treatment.
Fig. 3.—X-ray pictures, 1920. Both mandibular second premolars are missing.
Fig. 4.—Front and side views of models made in 1927.

Fig. 5 is a radiogram of the left third molar area taken in 1926, and Fig. 6 shows right and left third molar areas in 1928. Fig. 7 shows models of the case made in 1928. It will be seen from the radiographs that there are no third molars, and from the models that the protrusion of the whole mandibular dental arch was about one-eighth inch anterior to the maxillary arch at this time. The

alignment of the teeth was quite good, however; and the models could be placed in a good occlusal relationship, as is usual in these cases. This is shown in Fig. 8.

About this time the patient was persuaded to see an internist and was referred to Dr. Lewellys F. Barker, from whom I received the following report:

1. Dysplastic habitus with mandibular prognathism, but the sella turcica was normal and there were no other signs of an endocrine disorder.
2. Slight renal irritation with a trace of albumin and a few casts in the urine.

Fig. 5.

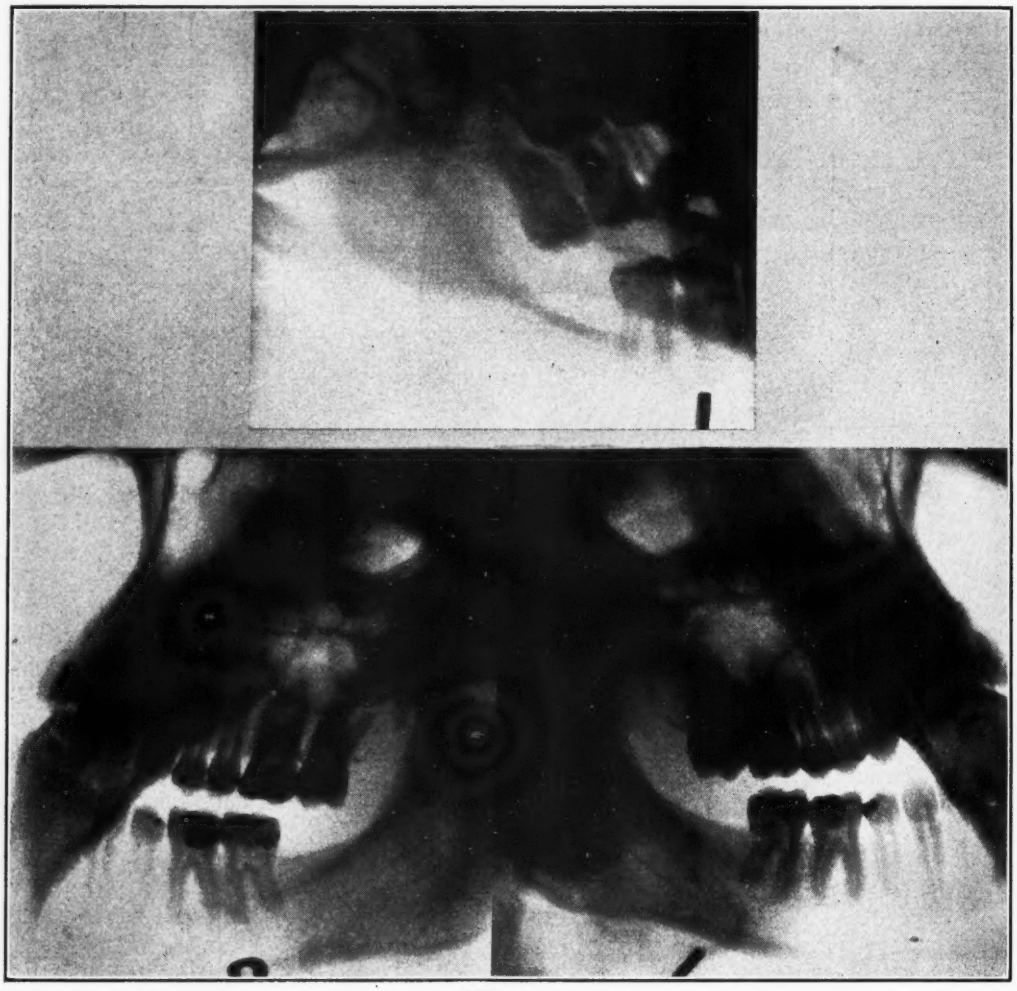

Fig. 6.

Fig. 5.—Radiogram of left third molar area in 1926.
Fig. 6.—Right and left third molar area in 1928.

3. Persistent bradycardia or slow pulse rate. This was a sign of a mild lack of balance in the autonomic or automatic nervous system. The earlier history of biting the finger nails indicated some tendency to nervousness.
4. Undernutrition by about fifteen pounds, but this is not at all bad for his age.
5. Slight tabagism, or the use of too many cigarets.

Although this does not corroborate my own opinion that the prognathism was due to an endocrine disturbance, I do not think it contradicts it, because I believe it was about this time or earlier that the imbalance which had existed in the patient's endocrine system was relieved through some compensation in the various glands, and the present status of the case shows that there has been

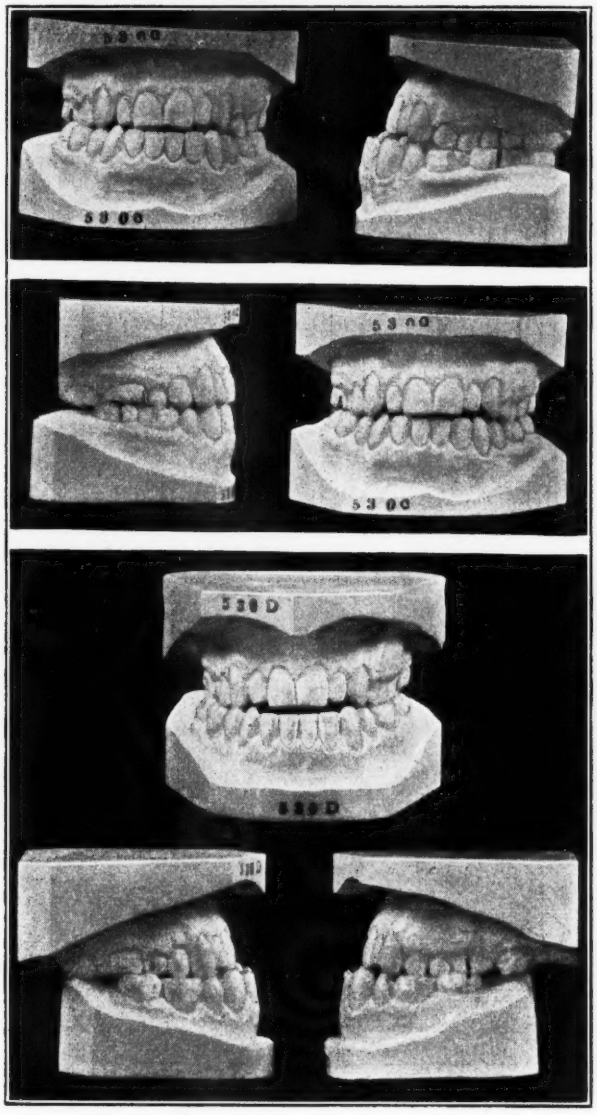

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7.—Models of the case in 1928.
Fig. 8.—Same models as Fig. 7, with maxillary model moved forward.
Fig. 9.—Models made December, 1935.

no very marked progress, if any, in the overdevelopment of the mandible since the 1928 models were made. I believe it is conceded by authorities in endocrinology (if there are authorities) that imbalances which persist over a number of years are often relieved, after which the functions of growth and development become normal.

In December, 1935, I asked this patient to return for observation. Fig. 9 shows models of the case made at that time. Fig. 10 shows extraoral radiographs, and Fig. 11 profile and front view photographs of the face, also made at this time.

From the foregoing, together with my close and anxious observation of the case over a number of years, and evidence accumulated from other ap-

Fig. 10.

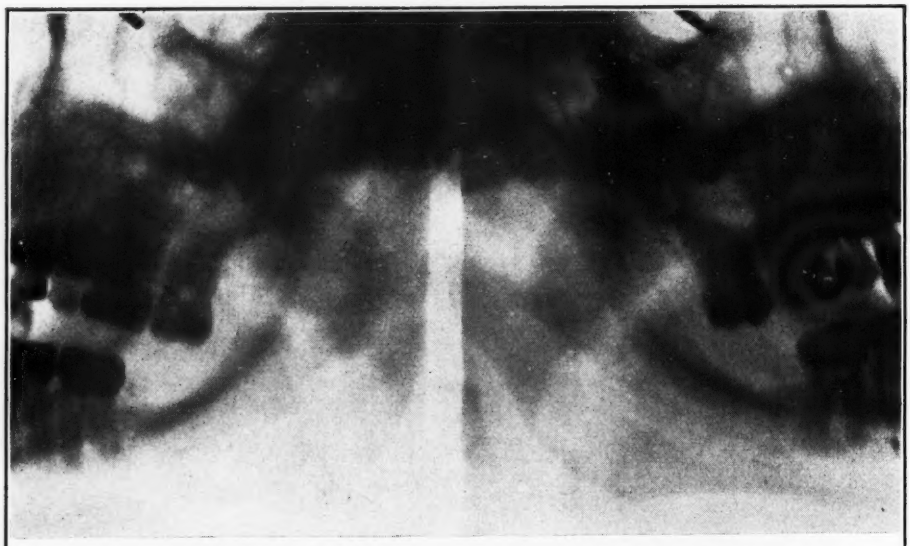

Fig. 11.

Fig. 10.—Extraoral radiographs made December, 1935.
Fig. 11.—Profile and front views of face January, 1936.

parently similar cases, I have formed the conviction that this patient had begun to suffer from an endocrine imbalance at, or before, the time the patient came to me; and the influence of this imbalance, while it did not prevent me from accomplishing considerable improvement in the case, did prevent me from securing a thoroughly satisfactory result at any time. My treatment to enlarge the maxillary arch and bring about a better relation of the maxillary and mandibular teeth progressed a little more rapidly than the overdevelopment of the

mandible, but as soon as treatment was stopped, the progressive overdevelopment of the mandible became apparent and continued until about the time I induced the patient to have a general physical examination with special reference to a disturbance of the endocrine system.

It is true that the models of the case, made two or three months ago, show a greater mesial relation of the mandible to the maxilla than do the models made in 1928; but the difference is slight, and in my opinion most of it can be accounted for by a straightening up of the mandibular teeth, which had been pulled and inclined as much distally as was possible during the period the patient was undergoing treatment.

A view of the profile seems to corroborate this theory. I have discussed with this patient the advisability of a resection of the mandible to permit reducing its present prognathous condition, and he is much inclined to have it done.

This patient has always suffered more or less from inability to breathe properly through the nose. He has a deflected septum on which the nose and throat specialists have been rather averse to operating. The tonsils, which were referred to earlier in the report as having been clipped, have given considerable trouble, and the patient had a tonsillectomy less than a year ago.

At the time this patient first presented for treatment, I still believed, as we had been previously taught, that Class III cases were usually induced by enlarged tonsils. I am still inclined to think that they can induce a forward shifting of the mandible in young patients which may become fixed, or even progressive as the occlusion is securely locked in the mesial position with the maxillary teeth, and is often also in lingual occlusion. In such cases the mechanics of mastication seem to have a tendency to drive the mandible farther forward. Such, at least, was my early conception of these cases. Today, I believe many of them, like the one shown here, are the result of some endocrine disturbance; and though my convictions are fairly definite, they are by no means unalterable, and if a better solution as to the etiology can be presented, I shall welcome it.

In talking with Dr. C. C. Howard in regard to cases which have been affected by an endocrine imbalance, it seems to me he has expressed the opinion that such a case as I have here reported (provided my diagnosis is correct) should not be treated during active glandular disturbance. I now believe this to be true, but I also believe that much can be done for such patients after the imbalance has been overcome either through natural compensation or by therapy. I hope Dr. Howard will have something to say in regard to this, for through association with the endocrine clinic in Atlanta, his opportunity for observation of malocclusions which might be attributed to an endocrine disturbance, has been unusual.

833 Park Avenue

GROWTH OF THE JAWS AND THE ETIOLOGY OF MALOCCLUSION

ALEXANDER SVED,* B.S., D.D.S., NEW YORK, N. Y.

(Continued from page 690, July)

CHAPTER XII

CONCLUSION

The hypothesis presented in the foregoing pages is a result of an intensive study of the etiology of malocclusion. The negative findings of Brash inspired this study, and the primary object was not to solve the etiologic problem but rather to generalize the known facts concerning it. At present we cannot be certain that there is a problem of the etiology of malocclusion, but the approach is made on the premise that the problem does exist. Proof is entirely lacking that malocclusions can be caused by injurious influences of a general nature, but it is equally true that the opposite is also not proved. For this reason, after the known facts were gathered, a generalization was made to correlate these facts in a logical manner.

Since the hypothesis was based on the premise that malocclusions may be the result of heredity or of local or general environmental influences, it became necessary to explain the mode of formation of those deformities which presumably are not inherited. This explanation had to include all established facts concerning growth and development, and also those conditions under which alterations of growth occur. These alterations of growth must take place if malocclusions are caused by environmental influences; for, if growth is not altered, deformities cannot develop. The correctness of the hypothesis depends upon the ability of nocive influences to retard and augment growth. If growth can be affected by nocive influences, then the general concept is true, although it may be erroneous in detail. The correctness of the hypothesis, however, is not to be considered important. Its confirmation will prove that general injurious agents can produce changes in growth and thus bring about malocclusions, but if it is found to be incorrect, then all malocclusions must be looked upon as inherited. This is the important issue.

The conceptions of Jansen are not applied in the original form, but they are used with modifications to explain harmful effects on growth. Brash rejects the entire explanation by the statement that: "It is quite certain that an explanation of jaw deformities by attributing them to assumed 'feebleness of growth' in the individual is no explanation, and cannot satisfy us from the etiological point of view. In the absence of compelling evidence, as for example of the relation of incidence to place in the family, any such view must remain highly speculative."

*Chief of Orthodontic Clinic of the Hospital of Joint Diseases.

It is a strange coincidence, but Brash himself furnishes a very definite proof of the correctness of Jansen's second principle of the feebleness of growth. The second principle is the "law of the vulnerability of the fast growing cell groups"; and, as it is explained in Jansen's introductory note, it means that "the measure in which growth is enfeebled is proportional to the rapidity of growth." In other words, everything else being the same, the faster growing parts of the body are more likely to be affected by injurious influences. This is true of the different parts of the body and also of the different cell groups of the same part. If we take, for example, a bone like the mandible, which grows at varying rates in the different directions, then according to Jansen's conception the dimension which normally increases at the greatest rate will be more profoundly affected. This is exactly the conclusion that was drawn by Brash from an analysis of Franke's measurements of normal and abnormal jaws.

In his summary to a lecture of the "Genesis and Growth of Deformed Palates," Brash places the following conclusions as first and second in importance. 1. "Malformations of the mandible appear as defects and excesses in the principal growth directions. The alveolar arch changes being probably secondary to those in the maxilla."

2. "The chief growth directions in the upper jaws are lateral and downward; variations in the relative amount of growth in these directions account for the differences in the extreme normal types of face. *Disturbance of growth is therefore likely to be expressed in these directions* and to affect particularly the site of growth that the median palatal suture and on the undersurface of the palate."

According to these quotations Brash arrived at the conclusion that "disturbances of growth are expressed in the principal growth directions." But the principal direction of growth means the direction of greatest growth, which necessarily implies a greater rate of growth in comparison with other directions. Greater rate of growth means greater cell activity and consequently a more rapid cell growth. Since the *"disturbances of growth are expressed in the principal growth directions," the fast growing cell groups must be more vulnerable and more likely to be affected by injurious agents.* Thus the conclusions of Brash confirm the observations of Jansen, and in the final analysis his conclusions are merely more limited statements of the law of vulnerability of the fast growing cell groups.

A striking proof furnished by Hellman seems to verify the correctness of Jansen's third principle which states that the feebleness of growth is characterized by enhanced sensibility and enhanced fatigability. If a nocive agent is capable of bringing about malformations of the jaws, it must affect the entire skeleton in a similar manner. Hellman, in an original communication, "What About Diagnosis and Treatment of Class II Malocclusion of the Teeth?" investigated the relationship existing between the height and the weight of individuals having Class II malocclusions. Since, on account of the scarcity of material, measurements of individuals having normal occlusion were not available, the standard adopted for comparison was the group representing Class I malocclusions. "On comparing the Class II, division 1 group, with the Class I

group it was found that they are both approximately the same in height and weight. But on comparing the Class II, division 2 group with the Class I group it was found that they differ considerably in both instances. If now a comparison is made between the two divisions of Class II, the difference is at once obvious. Thus the girls in Class II, division 1 are on the average taller throughout the entire range of ages from five to twenty years. The only exception is at seven years. The differences, though not great, are nevertheless consistent throughout. This makes it rather significant. In weight, too, the division 1 group is consistently heavier. It would seem then that the Class II, division 2 group is, as a whole, shorter and lighter.''

From an examination of another group of girls at an orphanage, Hellman arrived at the conclusion that while in stature those having malocclusion are the same on the average as those having normal occlusion, the malocclusal group is, on the whole, heavier. After comparing the girls at the orphanage with a group of girls from private practice, he makes the following statement.

''The question then arising is, if girls showing such high percentage of malocclusion are at the same time taller and heavier, is malocclusion really a detriment? I shall not attempt to answer this question. I shall, however, propound another one. Of course, whether or not malocclusion of the teeth has growth promoting qualities is not known. But, if according to this comparison, and I am sure the figures are correct, malocclusion is associated with increased weight and height, is there any particular kind of malocclusion affecting growth more than another?''

It is evident that malocclusions in themselves cannot be responsible for increased body height and weight. On further reflection we recognize the malocclusal group as composed of individuals affected by feebleness of growth of the type which is characterized by muscular weakness, enhanced body weight and height. The Class II, division 1 cases represent a milder degree of feebleness than the Class II, division 2 cases; and this, when judged from the point of view of height and weight, corresponds with Jansen's conceptions. The difficulties which Hellman experienced in the interpretation of his measurements at once become clear, and it no longer ''appears to be an advantage to have malocclusion of the teeth.''

Thus it appears that the conceptions of Jansen are not so highly speculative as Brash would have us believe, and a more detailed study of the feebleness of growth may result in a better understanding of the phenomena of growth. If it can be shown that persons with Class III malocclusions are on the average taller and heavier than those with the Class II, division 1 malocclusions, then the hypothesis presented in these pages can be considered proved. It will also be established that malocclusions and jaw deformities can be caused by general injurious agents, and that all malocclusions are not inherited. Indications are that persons with Class III malocclusions are on the average taller and heavier than persons belonging to other groups of malocclusion. This, however, should be proved by research.

The method of taking histories described in the foregoing pages has been in use at the Orthodontic Clinic of the Hospital for Joint Diseases for the past

four years. A good deal of difficulty was experienced by the staff in obtaining the proper information and making predictions regarding the probable outcome of cases. This can be acquired only by persistent application and continual guidance. The predictions made at the hospital clinic, however, tend to confirm this entire hypothesis. It is hoped that, in time, valuable statistical data will be available to prove that a growing body cannot be subjected to injurious influences without harmful effects, and that the mode of production of malocclusions and jaw deformities is explainable on that basis.

A RATIONALE OF THE APPLICATION OF MECHANICS IN THE TREATMENT OF MALOCCLUSION

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SINCE the earliest beginnings of orthodontia, mechanics have been employed in the treatment of malocclusion. Many theories have been advanced differing as to the type of force that should be employed and the directions of the forces. In the treatment of malocclusion, however, all have had the same purpose, the attainment of a normal occlusion. The object of treatment is to stimulate the parts that are deficient in the hope that they will attain a size that will be in harmony with the rest of the cranial structures. It has long been known that bone will respond to mechanical stimulation, and the works of Oppenheim and others have shown that intermittent forces are conducive to the stimulation of bone and that continuous forces tend to destroy bone. The works of Hunter, Brash, Keith, Hellman, and Broadbent have clearly set forth the sites and the manner of growth in the development of the mandible and of the maxilla. It was only necessary, therefore, to correlate the various researches and to interpret the application of forces in the treatment of malocclusion in the light of these researches.

The following explanation will limit itself entirely to the treatment of Angle's Class II, Division 1. In a subsequent article explanation will be made of the treatment of other types of malocclusion.

There are essentially four different theories regarding the treatment of these cases. One group, Dewey, McCoy (1927), and Dewey-Anderson, advise the stabilization of the maxillary denture, and they attempt to bring the mandibular denture forward by moving the mandibular teeth forward. The following quotation from Dewey and Anderson[1] is typical of their point of view.

"The maxillary molars are probably not too far forward in the majority of true distoclusion, Class II, Division 1, cases. Such being the case, a plan that will approach the ideal result must be the one that will not move these teeth backward. Therefore, efforts are directed toward moving the mandibular teeth forward and developing the mandible."

The followers of Angle attempt to stabilize the mandibular denture and move the maxillary teeth back. Strang[2] says:

"When the maxillary teeth are moved distally, in order to obtain correct inclined plane relationship, without disturbing the temporomandibular articulation and its association structures, the orthodontist is simply taking the patient back a few years in his life and placing his upper teeth about where they were when the mandibular growth stopped and then teaching him to use the power

plant in such a way that these years of faulty growth will be rapidly spanned and as much normal growth and development speedily obtained as is possible under the handicap of still imperfect and somewhat artificial function."

Rogers[3] relies to a great extent on muscular stimulation to bring about the necessary change after removing mechanical interference: "There are some who continue the use of intermaxillary elastics over a long period of time in their efforts to correct these cases, but I have experimented both with the use of the elastics and with the increased function of the muscles of mastication. With the latter alone or in combination with intermaxillary elastics the final satisfactory result seems to be obtained more quickly—simply because the change in form which is required to make the neutroclusion permanent occurs in less time when under an increased functional stress."

This was essentially the view held by Kingsley many years ago.

The fourth group favors the extraction of maxillary teeth.

"One of the first plans that we have any record of is one in which the case was treated by the extraction of some teeth. An upper molar on each side was extracted; first, to establish harmony in the size of the arches, and second, to reduce the protrusion of the upper anterior teeth. This plan of treatment made the upper arch conform to the underdeveloped lower arch, improved the occlusion slightly and changed the facial profile. Normal occlusion and normal facial outlines were not recognized by this plan."[4]

In 1926 Simon tried to justify the extraction of maxillary teeth, but this time instead of the molars he chose the first premolars. Since then he and his followers have adhered to this procedure in the treatment of some of these cases.

Before describing the dynamics that should be employed, let us review the manner of the growth and development of the face. John Hunter was the first, in his historical masterpiece, "On the Natural History of the Human Teeth," to show by simple comparison of four half jaws how the mandible grows at the posterior border. "The jaw still increases in all points till twelve months after birth, when the bodies of all the six teeth are pretty well formed; but it never after increases in length between the symphysis and the sixth tooth; and from this time, too, the alveolar process, which makes the anterior part of the arches of both jaws, never becomes a section of a larger circle, whence the lower part of a child's face is flatter, or not so projecting forward as in the adult.

"After this time the jaws lengthen only at their posterior ends; so that the sixth tooth, which was under the coronoid process of the lower jaw, and in the tubercles of the upper jaw of the fetus is, at last, viz. in the eighth or ninth year, placed before these parts; and then the seventh tooth appears in the place which the sixth occupied, with respect to the coronoid process and tubercle; and about the twelfth or fourteenth year the eighth tooth is situated where the seventh was placed. At the age of eighteen or twenty, the eighth tooth is found before the coronoid process in the lower jaw and under, or somewhat before the tubercle in the upper jaw, which tubercle is no more than a succession of sockets for the teeth till they are completely formed."[5]

Hunter and more recently Brash verified these conclusions by madder feeding. Sir Arthur Keith and Mr. Campion by superimposing the maxilla of a child aged four years on the same parts of an adult, by superimposing the corresponding alveoli of the deciduous and permanent teeth as closely as possible, show the sites of growth in the maxilla.

Hellman has shown by cephalometric measurements that the face first grows backward and then there is a readjustment and the face moves forward with relation to the brain case. From these references then, we may conclude that stimulation for the development of the maxilla and the mandible must first create a backward growth and then nature can make the adjustment forward.

In a critical study of Class II, Division 1, Sir Arthur Keith, Oppenheim, Broadbent, and Hellman have placed the sites of deformity in exactly the same places. They show that in Class II, Division 1 there is a lack of development anteroposteriorly in the maxilla as well as in the mandible. Milo Hellman says: "It has also been pointed out that in Class II, Division 1, the face as a whole is subnormal with reference to anteroposterior dimension, the mandible being relatively still more so than the maxilla."[6]

Therefore, the purpose of the treatment should be to develop the maxilla and the mandible to a size sufficiently great to accommodate the teeth.

Wolff, Jansen, Oppenheim, and others have demonstrated the response of bone to mechanical stimulation. *Bone is destroyed at the site of pressure, but grows in the direction of pressure.* If pressure is applied in a labial direction to a mandibular incisor, bone is destroyed on the lingual surface of the labial alveolar plate and is formed on the labial surface of the labial alveolar plate. This phenomenon is explained by Wolff's law, which states in essence that bone forms in response to a demand for it, if the force is intermittent and not excessive.

Therefore, based upon the findings of these investigators, namely that in Class II, Division 1 there is a lack of development anteroposteriorly of the maxilla and of the mandible, efforts should be made to develop these bones and from the findings of Wolff, Jansen, Oppenheim, and others, we may conclude that *pressure applied to the sites of normal growth in the direction of normal growth should stimulate these bones to develop.*

Murk Jansen says: "That pressure stresses can promote or cause bone formation has been justly agreed upon by every investigator as an established fact."[7]

Therefore pressure should be applied to stimulate the mandible in the retromolar region and the maxilla in the region of the tuberosities. If bone will grow in response to these stimulations, then by a secondary adjustment the face will move forward in relation to the cranial base.

A careful analysis of the denture showing a Class II, Division 1 type of malocclusion shows the following characteristics which have been recognized and accepted by all authors. There is a narrow contracted arch with protruding maxillary anterior teeth, and all the maxillary teeth manifest a decided mesial axial inclination. In the mandible there is an exaggerated curve of Spee pro-

duced by the mesial axial inclination of the first molar and a distal inclination of the six anterior teeth. As a result of these axial inclinations the distance between the mesial surface of the first molar and the distal surface of the canine is insufficient to accommodate the mesiodistal diameters of the two premolars. These two teeth are, therefore, locked below the line of occlusion, thus creating the excessive curve of Spee. The body of the mandible, therefore, does not receive the entire benefit of the stimulative forces due to natural growth and of the anterior component which should be transmitted through the approximal contacts of the teeth. In addition, when in occlusion there is a considerable reduction in the dental height resulting in a marked overbite.

In the attempt to create the mechanical stimuli necessary to establish normal bone growth resulting in a normal occlusion of the teeth, forces should be used that will stimulate the body of the mandible to attain its normal dimensions anteroposteriorly and laterally. In the maxilla forces should be similarly used to stimulate the development of the maxilla both anteroposteriorly and laterally. If mechanical stimuli are properly used, the overbite will automatically be corrected. Many authors have failed to recognize the necessity for developing the maxilla as already referred to and have attempted to correct this type of malocclusion by dragging the mandibular teeth forward. It is this type of treatment that so frequently results in the dual bite referred to by Rogers.[3]

As has been quoted already, those who follow this form of treatment attempt to stabilize the entire maxilla and utilize intermaxillary elastics for the purpose of bringing the mandibular teeth forward. When they do not meet with success, they use more and more intermaxillary force. The more force they use, the less possible it becomes to achieve success and the more readily does the patient acquire the so-called dual bite. Their failures are caused by the fact that in attempting to stabilize the entire maxilla there is insufficient stimulation in a backward direction for the necessary development of the maxilla. In the mandible there is absolutely no backward stimulation and therefore no stimulation for the development of the body of the mandible. The more they increase their intermaxillary forces the less possible it is to obtain the stimuli needed for the development of either jaw. This is true because excessive pressure in the maxilla interferes with any possible backward stimulation as has been shown by many investigations. Gentle forces in the proper direction create a mild congestion or stasis at which time the calcium salts are taken up in solution. Then, as the stasis disappears and the circulation again becomes normal, the salts are deposited in the formation of new bone in the direction of pressure. The excessive forces when used create a marked stasis, the local blood vessels are never permitted to resume a normal condition, and new bone formation and the deposition of the calcium salts therefore never occur.

"Bone is formed under the influence of a local humoral condition. The pressure which has been applied leads to the resorption of a certain quantity of bone and provokes a local calcium excess. In the free periods, except for momentary pressure, columns of new bone or new layers of bone are formed; they will be resorbed on resumption of the pressure.

"Thus pressure in the final analysis seems to be excitant of bone growth, but through complex mechanism. It determines first a resorption and local calcium excess. Then, the pressure having ceased, a new bone is formed because of the antecedent absorption and the local calcific excess. But, as we see it, the pressure acts only by preparing the proper medium for the laying down of bone. The latter operates only in the absence of pressure. We believe that the researches of Jores are of great interest in showing that the essential element of the morphogenesis of bone lies in an alternation of periods of pressure and repose. When there is no pressure, bone is formed; when there is strong enough pressure, it disappears. All bone morphogenesis is bound up with processes which unfold themselves between these two extremes."[8]

In the mandible excessive intermaxillary forces prohibit any backward stimulation which is so necessary for the development of the body of the mandible. Furthermore, these excessive forces create a physiologic fatigue of the muscles, and the patient automatically slides the mandible forward to seek relief. This is another cause of the so-called dual bite.

There is another group of orthodontists who empirically drive the maxillary teeth backward. This group meets with much greater success in the treatment of these cases. They are developing the maxilla by creating stimuli in the proper direction for the necessary bone growth. Of all the authors quoted, Angle and Strang are the only ones who advise this modus operandi. They, however, are not aware of what they are accomplishing because Strang says: "When the maxillary teeth are moved distally in order to obtain correct inclined plane relationship, without disturbing the temporomandibular articulation and its association structures, the orthodontist is simply taking the patient back a few years in his life and placing his upper teeth about where they were when the mandibular growth stopped and then teaching him how to use the power plant in such a way that these years of faulty growth will be rapidly spanned and as much normal growth and development speedily obtained as is possible under the handicap of still imperfect and somewhat artificial function."[2]

While their measure of success as a result of stimulating the maxilla properly is much greater than that of the former group, they may still meet with many failures unless they unwittingly create the necessary backward stimulation in the mandible. Those, however, who follow Strang's procedures closely will obtain this necessary backward stimulation in the mandible if they do not use too much intermaxillary force because, while he emphasizes "establish a stationary anchorage on the mandibular arch and guard this zealously," he also says "stationary anchorage automatically appears in the mandibular denture with bracket engagement of these teeth. It will be strengthened as the exaggerated curve of Spee is removed from the mandibular arch wire in order to tip the molars upright, elevate the premolars and depress the incisors. . . . Intermaxillary elastics can be adjusted as soon as there is sufficient bracket engagement on the mandibular arch wire to assure stationary anchorage." If the intermaxillary elastics are not worn until after these tooth movements have been accomplished, there will have been the necessary backward stimulation for the development of the mandible. This group of orthodontists therefore is empirically treating Class II, Division 1 properly.

CONCLUSIONS

1. Growth takes place in the maxilla in the regions of the tuberosities and in the mandible in the retromolar regions.

2. Efforts should be made to stimulate these growth areas.

3. Gentle, intermittent pressures stimulate bone growth in the direction of the pressure.

4. Create a backward stimulation in both jaws.

5. Use gentle intermaxillary force so as to avoid interference with the backward stimulation in the mandible and to avoid excessive pressure in the maxilla.

6. When the necessary backward growth has taken place, the face will shift forward with relation to the cranial base.

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SIMPLIFIED ORTHODONTICS

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IN SPEAKING of simplified orthodontics, I do not wish to detract from the value of the various complicated appliances when their use is indicated. I wish rather to emphasize the advantages of employing simple appliances, the forces of which are so much easier to analyze and are more definitely directed.

Perhaps there is a wholesome trend to get back to fundamentals, as facts must not be ignored and limitations must be recognized. In our mad desire to employ the latest method, perhaps we have experienced the chagrin of seeing no better ultimate results brought about than with some of the older methods. Certain refinements have been added, but the principles are much the same whether we use the round, square or flat wire, or whether we use a pulling or pushing force. The ability to analyze the forces, the action and reactions, is all important.

It is a long tiresome experience at best for a small child to be subjected to orthodontic treatment. It becomes our duty to avoid all unnecessary discomfort possible and to realize that we are treating the whole child and not just teeth.

It is with the hope that by showing some procedures which I have found useful over a period of thirty-seven years, I may help to make the process easier for the patient and for the operator, and perhaps spare the operator the chagrin and the patient the grief of a relapse, that I am showing these illustrations.

Fig. 1 shows a Class II case. As can be seen, there is a distal relation of the mandible to the maxilla on both sides, and the arch is contracted. This case was treated with the maxillary labial wire and the mandibular lingual arch with the intermaxillary elastics. With a Class II case it has been my experience that the intermaxillary elastics are invaluable, and the ultimate result depends upon the way in which the arch wire, especially the labial arch wire, is manipulated. Fig. 2 shows the result obtained by twelve treatments. The occlusion was established. As the child came quite a long distance, the trips were as infrequent as possible. The premolar region was expanded the amount that is indicated by the pencil marks on the models of Fig. 3. By the manipulation of the labial wire and the palatal arms which were soldered to the molar bands, the expansion in the premolar region was obtained without ligatures.

Fig. 4 is a typical Class II, Division 1, in which there is a bilateral distal relationship. Fig. 5 shows the case corrected with the simple labial wire and with the lingual wire on the mandibular arch. In the clinic of the Harvard Dental School, this is almost a universal appliance; that is, with a band upon each maxillary lateral incisor, with the labial wire, and with the lingual wire

Given before the New York Society of Orthodontists, November 18, 1935.

below. As Dr. Baker points out, however, the labial wire below is perhaps in many cases to be preferred to the lingual wire. When the mandible has a regular alignment of the teeth, I am inclined to use the lingual wire for the mandibular arch. Fig. 6 shows a comparison of the two arches, before and after treatment. The pencil marks indicate the expansion which has been accomplished in the premolar region. I want you to notice that there is no tipping of the posterior teeth whatever. There seems to be a carrying out bodily of the teeth without tipping; and furthermore, without the rigid attachments upon all the teeth, the anterior teeth are made as erect as is desired. I cannot see the necessity of banding every tooth in every case. An edgewise arch, or ribbon arch, no doubt has a place,

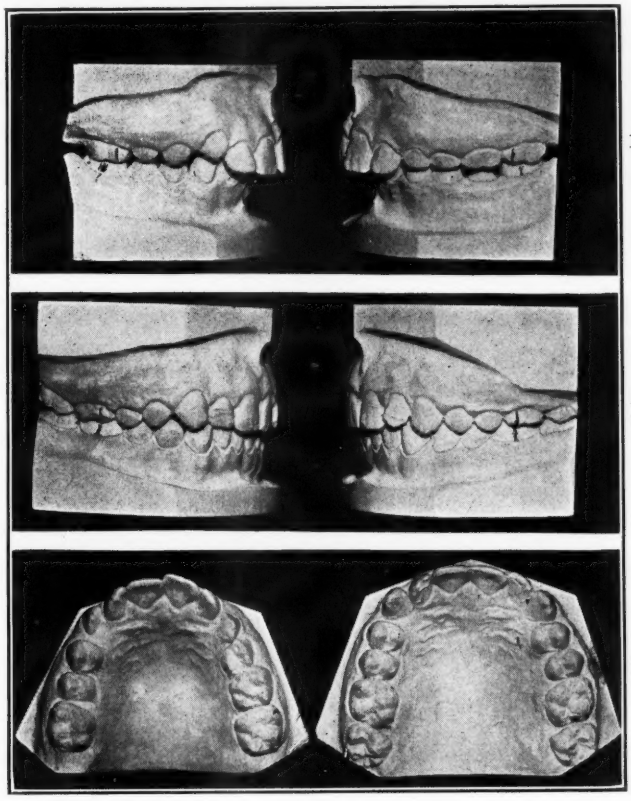


Fig. 1.

Fig. 2.

Fig. 3.

but it seems to me to be unnecessary in every case. When an arch form can be obtained without banding all the teeth, there is less danger to the soft tissues of the mouth and also less danger to the hard tissues. By the hard tissues I mean the alveoli and also the root ends. With attachments upon the lateral incisors there is a reaction upon the two central incisors, which is desirable. Fig. 7 shows the mandibular arch before and after treatment.

Figs. 8 and 9 show the appliance which I am inclined to use in many of the Class II cases. This illustrates the way that I have found desirable to manipulate the arch wire. By bending the extremities of the arch wire inward and then forcing the arch wire into the buccal tubes, which have a different alignment, there is a rotating force on the molars. Because the stiff, rigid palatal arms are soldered to the molar bands, the rotating force of the molars causes an

Fig. 4.

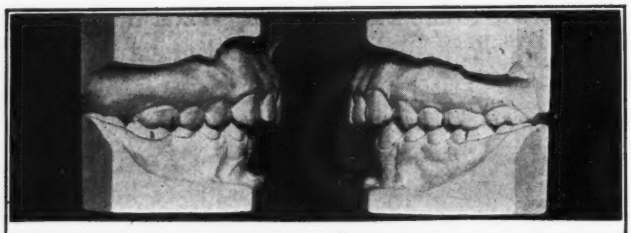


Fig. 5.

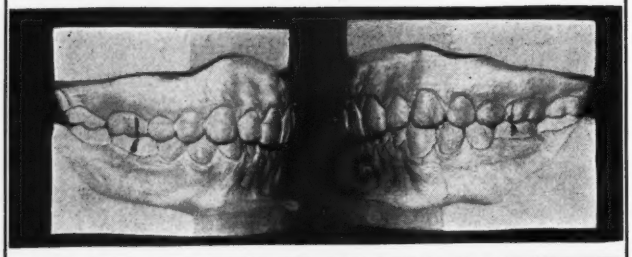


Fig. 6.

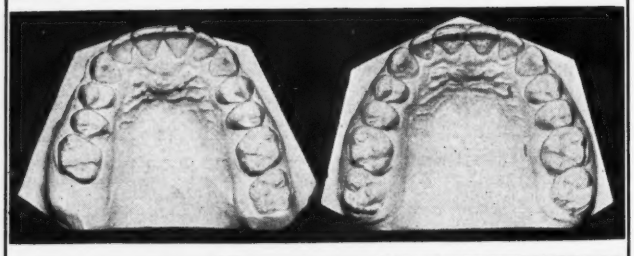
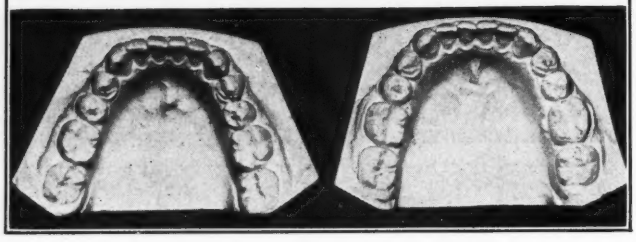


Fig. 7.



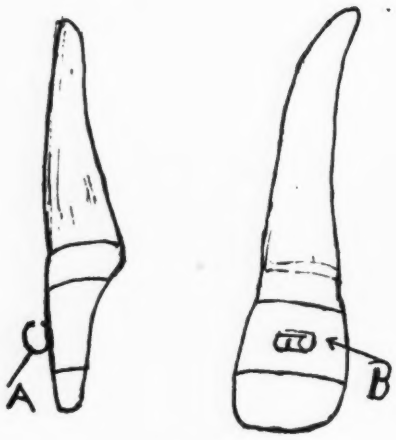


Fig. 8.

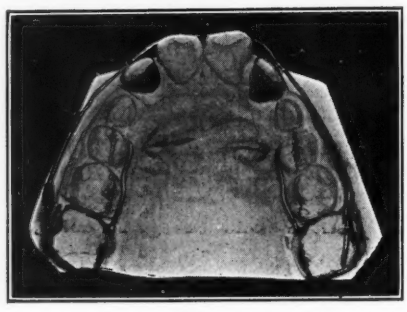


Fig. 9.

expansion in the premolar region, where it is most needed. The attachments for the lateral incisor bands, Fig. 8 *A* and *B*, have been developed from an idea of Dr. Ralph Gove of the Harvard Dental School Clinic. It is different from the McCoy open tube in that the opening is toward the gingiva instead of forward. With this arrangement there is much less danger of displacement of the arch wire forward, and the open tubes may be pinched together so that the arch is absolutely secure. *B* is the front view of the attachment. These open tubes are made individually so that the grain of the gold will be at right angles to the arch wire and therefore not so liable to split. These were first made by using pieces of tubing, but it occurred to me that perhaps there would be less danger if they were made in the way I suggest, by rolling up individual tubes, and they have proved to be very useful. To the arch wire may be added the erecting spurs as desired if more root movement is wanted. In most cases, how-

Fig. 10.

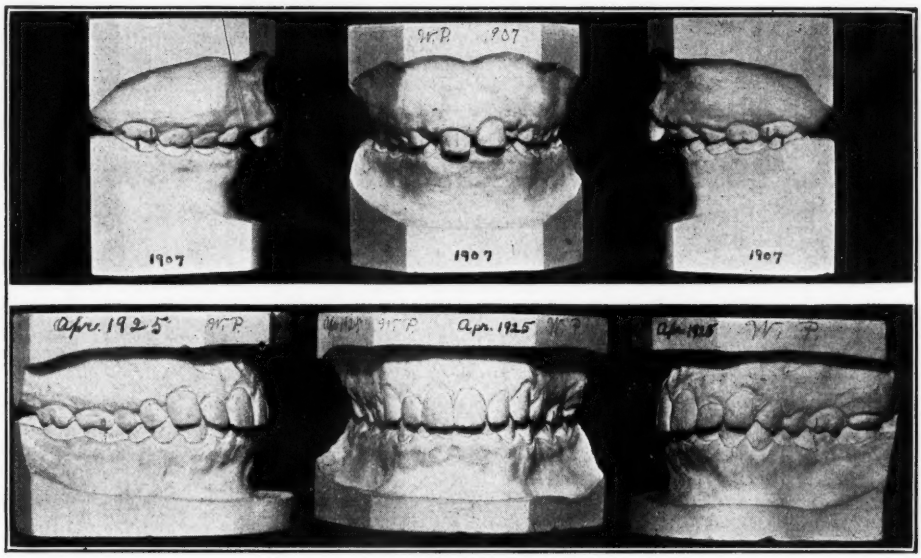


Fig. 11.

ever, it seems unnecessary to have any apparatus causing root movement of two central incisors. The arrows indicate the force exerted by the rigid palatal arms upon the crowns, in the premolar region. The possibilities of this simple arch wire were not apparent to me until perhaps the last four or five years.

Fig. 10 illustrates one of my older cases. The true test of the success of a case is with the ultimate result. This patient was a boy seven years old. The two central incisors had just erupted, the lateral incisors were not fully erupted. There was a bilateral distal condition. He was a small, undersized child, a typical mouth-breather. In 1907 I treated the case with two old-fashioned labial arches. He was given all kinds of advantages, including travel and exercise; he was sent to school in Arizona and also in Switzerland. The ultimate result is seen in Fig. 11. This result shows the advantage of treating the whole child as well as the teeth. This boy later became an athlete at Harvard. He rowed on the Harvard crew, and he grew to be a wonderful specimen of physical

ability. When I originally saw him he was an undersized and a pathetic little boy. The bicuspids have as nearly perfect locking as any case you would care to see. The overbite is quite perfect. These teeth have remained in as good position as this for ten years, which is about twenty-eight years after the case was first treated, so I believe the case is thoroughly settled.

Fig. 12 is another interesting case in that these are all deciduous teeth. It has not been my privilege to see many of the deciduous cases carried through to an ultimate end. The first models were made in 1920, when the child was

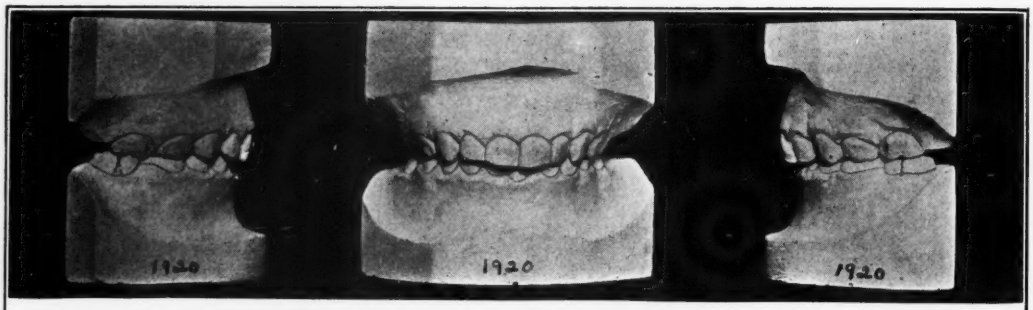


Fig. 12.

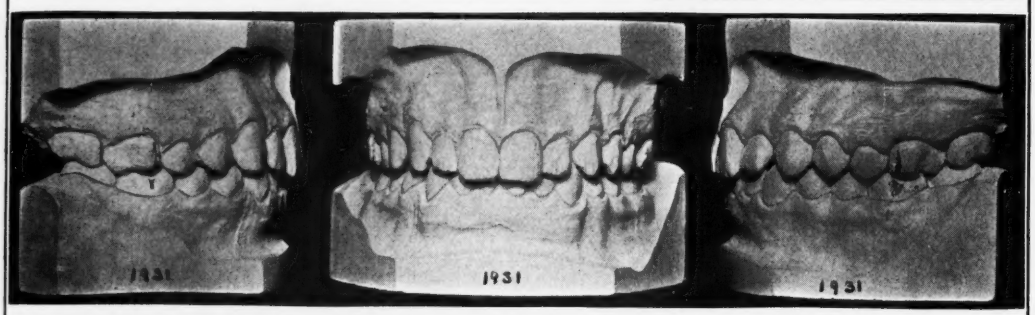


Fig. 13.

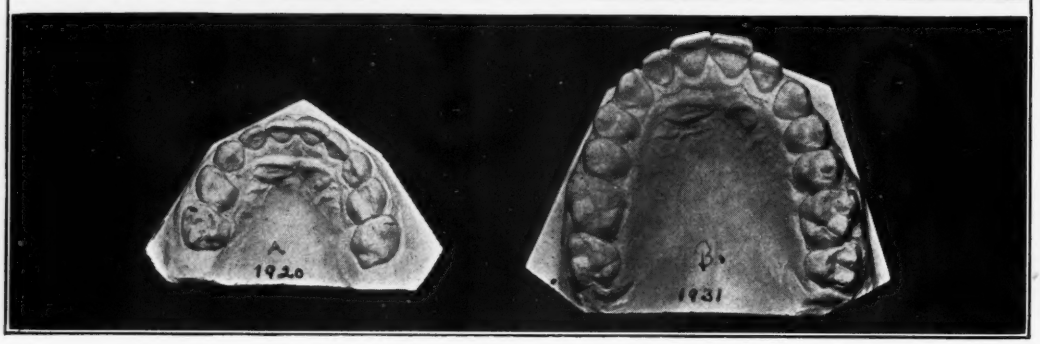


Fig. 14.

five and one-half years old. He was undersized and troubled with asthma, and his mouth was open continuously. He was sent to me by his physician, who said that there was something wrong with the maxilla. It was so narrow that he believed orthodontic treatment might improve the child's breathing. Fig. 13 shows the ultimate result after ten years of treatment. The appliances were not in place all the time. The patient was treated with lingual and labial arches, intermaxillary elastics, and incline planes, and in about every other way that I could devise. In 1931 the occlusion was very well locked, the overbite was quite perfect, and there was no question or doubt about the interlocking of the bicuspids and molars. Perhaps you notice that the first molars are tipped out

so that the anterior buccal cusps of the maxillary first molars are tipped out as they should be. Fig. 14 shows views of the maxillary arch before and after treatment. The second cast shows the case as it was in 1931 after all the premolars and molars were in position. I want you to notice the arch form. The first molars are not tipped out buccally at the distal, as used to be the case with our first efforts. To carry out the mesial buccal cusp is, I think, the proper treatment in such a case and in most cases.

With some of these cases I shall try to indicate what has been responsible for the result. In the case shown in Fig. 15, an incline plane, what I call a slide, was adjusted to the first premolar. This slide was adjusted first upon one side, and later, one was adjusted upon the other side. More than anything else, I believe, outside of the intermaxillary elastics, these contributed to the success of this case. These slides have the function of settling the occlusion. Such a slide prevents a dual bite, which is the bugbear of all Class II cases. I believe it is just as necessary to make it difficult for a child to bite in a wrong place as it is to remove interferences during the treatment. It is desirable to

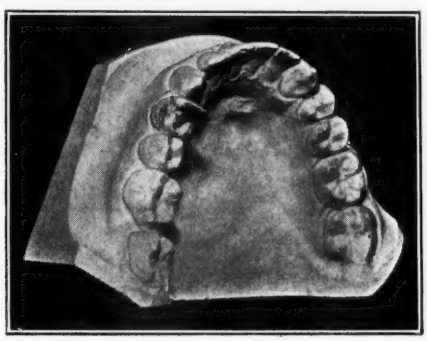


Fig. 15.

place an interference to prevent the wrong relationship of the jaws; otherwise I am sure disappointments will occur. I often apply an incline plane to a maxillary molar, which will go back of the distal buccal cusp of the mandibular molar. I employ all the inclines I can think of, sometimes upon the maxillary incisors, sometimes upon the bicuspids, and sometimes upon the maxillary molars. I have employed slides for thirty years and I would dislike to treat Class II cases without the benefit of them.

Fig. 15 shows one of my first patients. Treatment was started in 1903. This patient was treated before we had edgewise arches, before we had ribbon arches, before we had pin and tubes, and before we had lingual arches. The case was treated with the simple labial wires, maxillary and mandibular. The maxillary first permanent molars were palatal to the mandibular first permanent molars, and the maxillary arch was quite narrow (Fig. 17). I showed the case in 1905 before the Massachusetts Dental Society.

Fig. 16 shows the profile and front view of the boy before treatment in 1903. You can see the short upper lip, etc. Figs. 17 and 19 show the ultimate result in 1922, and the arch relations have remained quite perfect since that

time. Dr. Baker believes that this is one of the earliest cases treated with the intermaxillary elastics, that has been reported before this society. That may or may not be, I do not know. At any rate, the case was treated in 1903 with intermaxillary elastics, and the arch relations have always been maintained. There is one-half inch difference between the width of the arch after treatment

Fig. 16. Fig. 17.

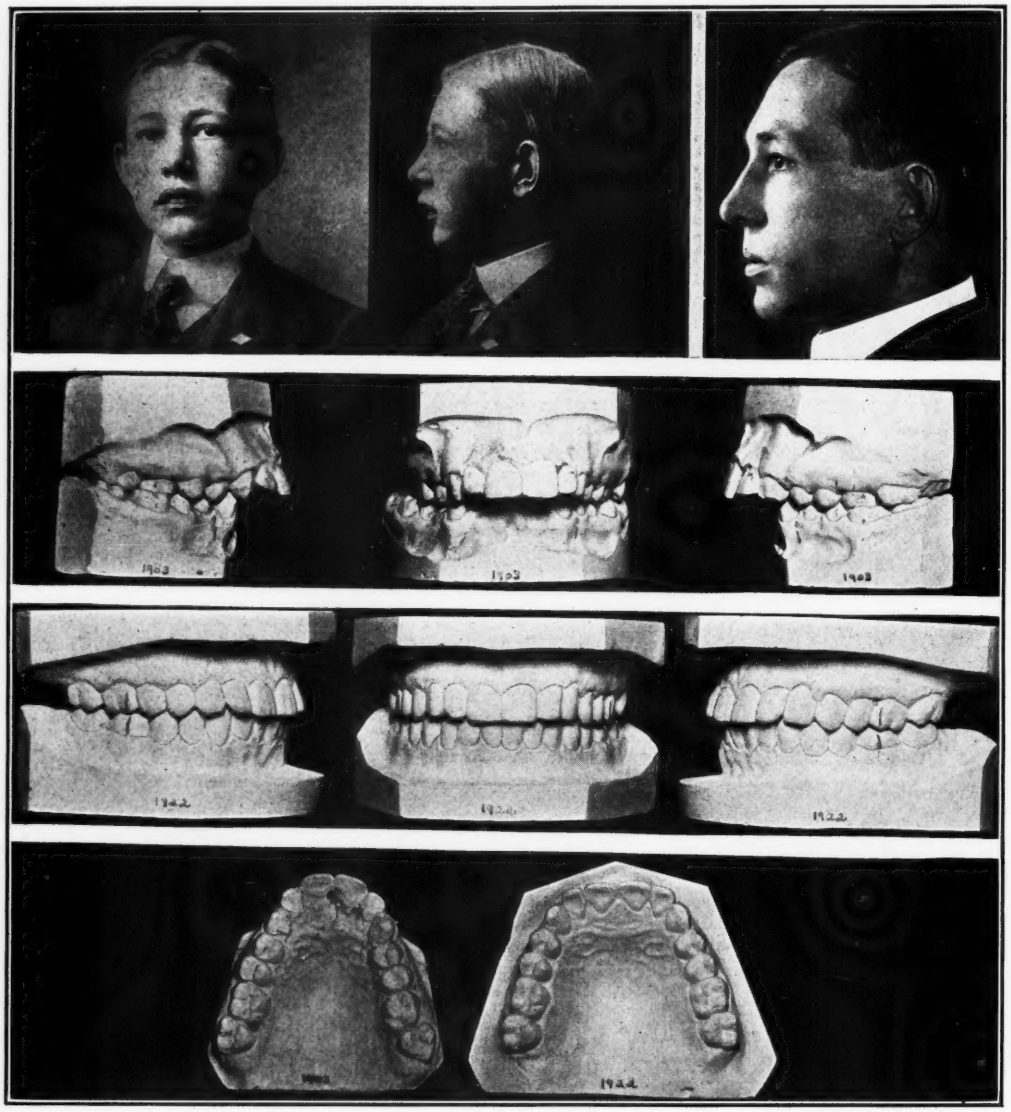


Fig. 18.

Fig. 19.

Fig. 20.

and that before treatment. In this connection I cannot refrain from speaking of the work of Dr. H. A. Baker in whose office I was for six or seven years. His sympathy and understanding were a wonderful inspiration to me, and the enthusiasm he displayed was always a help. He had the power to analyze forces and produce results which were comparable to and perhaps better than most of the results we obtain today. I want to add my tribute to Dr. H. A. Baker for the inspiration he gave me for orthodontia. Fig. 17 shows the profile of

the young man in 1922. You can see how he had developed. The short upper lip had gone. He was a perfect nose breather. The mandible had been developed. The pull of the intermaxillary elastics, perhaps, had made the body of the mandible develop, and possibly there had been a slight change in the condyle. I think there is a chance for further research. I do not really know what does happen. Figs. 19 and 20 show comparative views of the maxillary arch.

Fig. 21 is an extreme Class III case which was treated with two labial arches. Fig. 22 shows the ultimate result of the case. The interlocking of the teeth and the overbite are quite enough to assure me that the case will be secure. It has been my experience that you have better control and you can analyze the forces much better with the labial arch than with a lingual arch in a case such as this. The success of such a case depends on the overbite, I believe. With the lingual

Fig. 21.

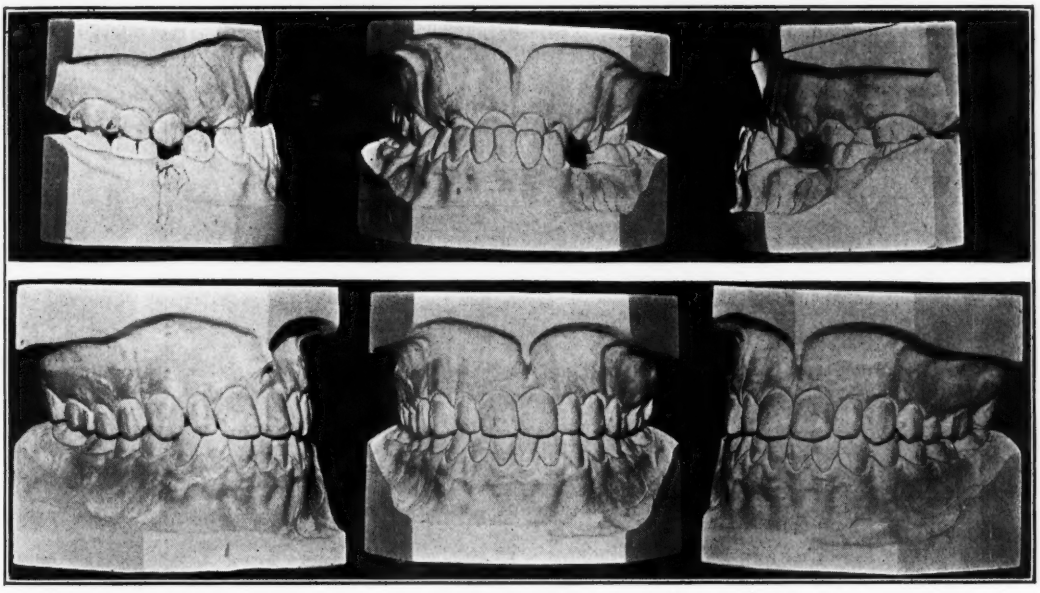


Fig. 22.

arch there is a tendency toward an open-bite, which is to be deplored in a Class III case. The lingual arch, in my opinion, is not indicated as often in the maxilla as in the mandible.

At this point I wish to quote from a paper of Professor Aleš Hrdlička, given before this society last spring: "The progress of nature is not through the narrow lanes of uniformity but through the broad avenues of variability." I think it sums up very well the question of the progress of nature. We know this, but still we seem to ignore the principle. We should apply this principle in our work, for we know that no face is exactly symmetrical. The late Dr. C. Edmund Kells of New Orleans expressed the same idea: "The extremist who is governed by an inflexible rule, which rule is at variance with common sense and expediency, is to be pitied, and his patients are to be pitied all the more. Thirty-two teeth in perfect alignment are a wonderful asset to the possessor, but untold millions of persons are in happy ignorance of some existing maloc-

clusion and go and lead uneventful lives just the same. Normal occlusion, while desirable, is not absolutely essential, we must ever bear in mind.'' It seems, however, to be necessary to go through eras of striving after doubtful truths and false ideals.

The two pictures in Fig. 23 are from the specimens of Dr. Percy Howe of the Forsyth Dental Infirmary. To my way of thinking, they show the causes

Fig. 23*A*. Fig. 23*B*.

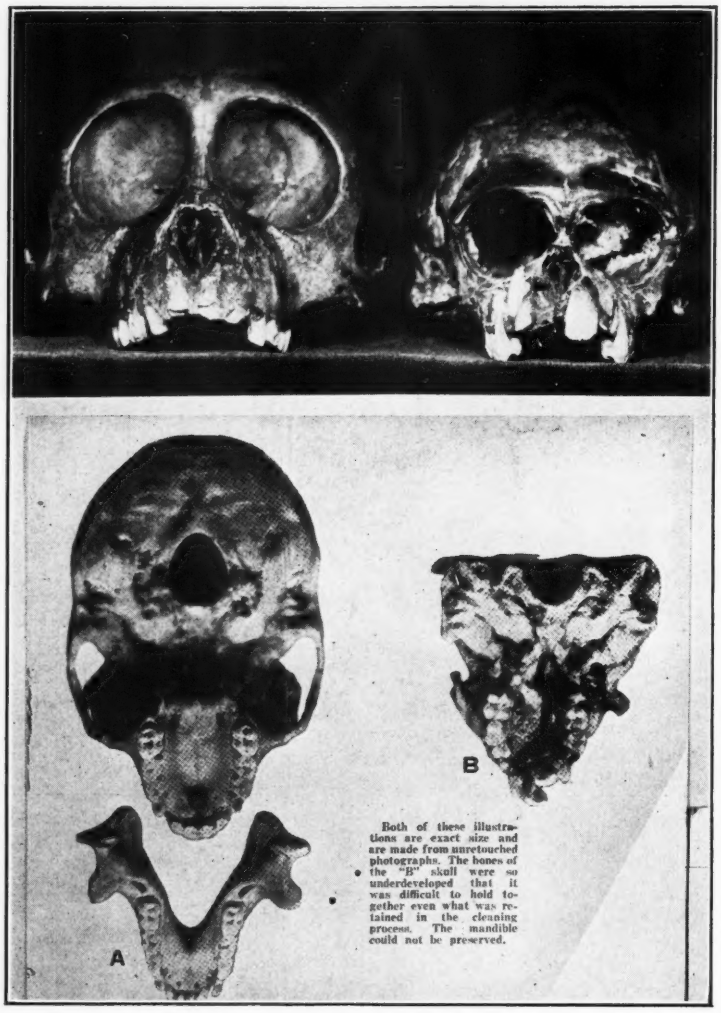

A
B
Both of these illustrations are exact size and are made from unretouched photographs. The bones of the "B" skull were so underdeveloped that it was difficult to hold together even what was retained in the cleaning process. The mandible could not be preserved.

Fig. 24.

of many of our malocclusions. Malocclusion is a question largely of nutrition. These two monkeys were experimented on by Dr. Howe. Monkey A had a normal diet; this monkey proved to have sound bone, good development of the maxilla, good vertical growth, and a chance for thirty-two teeth. Monkey B had a deficient diet and spongy bone; he could not breathe readily through his nose; in fact, Dr. Howe told me that Monkey B breathed so that it sounded as though he were snoring all the time. He could not obtain air through his nostrils; he had to breathe through his mouth. The bone was so spongy that the mandible could

not be preserved at all; it fell apart. The mandible of Monkey A was perfect. The incisor teeth were originally perfect, but during handling these teeth have been broken off, but that was after the monkey's death.

Monkey B had so little vertical growth of the face that the permanent canine actually protruded into the orbit. Now, the case of Monkey B is comparable to that of many children who come to us for treatment. In my opinion, to expand such an arch to contain thirty-two teeth is like building a house on mud. The

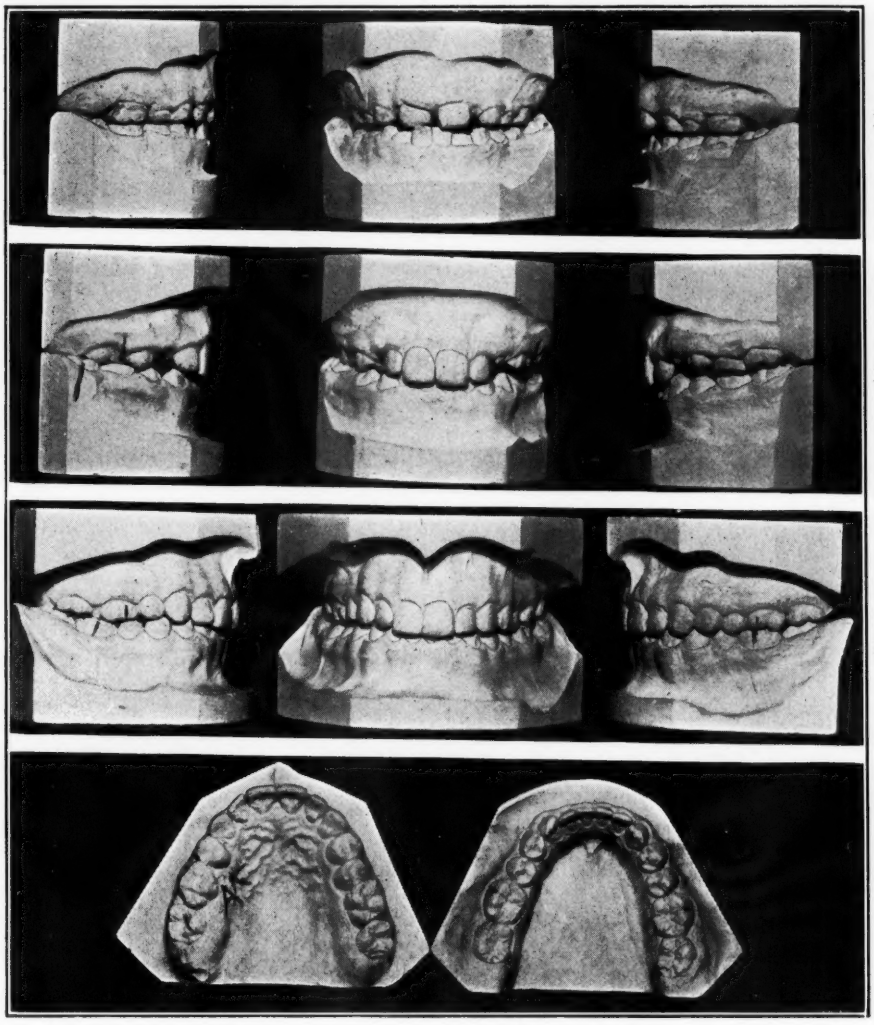


Fig. 25.

Fig. 26.

Fig. 27.

Fig. 28.

teeth would not stay in place if you moved them, and therefore I think such treatment is illogical. Notice the disproportion between the size of the teeth and the size of the bone. The teeth of Monkey A, if I remember rightly, are all deciduous teeth. Monkey B was a trifle older and his permanent teeth were erupting. Altogether, I think this is an excellent example of what we have to contend with. Fig. 24 is a palatal view of the same monkeys. The teeth of Monkey A are shown to be in perfect condition. This picture of the skulls was taken before that shown in Fig. 23, so the incisor teeth of Monkey A are perfect, while in the previous picture the incisors are broken. Monkey B had mushy,

unstable bone which was so plastic that the muscle pull misplaced the teeth. Notice the integrity of the smooth, stable bone of monkey A.

Fig. 25 is an interesting case in that the child had very little space between the two deciduous cuspids, and as the first permanent molar erupted on the right side, it assumed a position above the second deciduous molar so that the molar was exfoliated. There was nothing left of the second deciduous molar, except the capping of enamel. The maxillary incisors were carried over the mandibular incisors, and that was practically all I had to do with the case (Fig. 26). Fig. 27 shows the way the case developed. After the maxillary incisors were carried over the mandibular incisors, function did everything that was necessary. In due time I removed the second bicuspid, which erupted palatally. Fig. 27 shows the condition in 1928. Fig. 28 is a view of the maxillary and mandibular arches. At A is where the second bicuspid was removed, and I shall have to leave it to you to decide whether I did right or not. I believe that to adhere to an inflexible rule is not always good judgment.

To prove my last statement, Fig. 29 shows casts I had made of the teeth of the mother of some of my patients. I have treated the four children of the

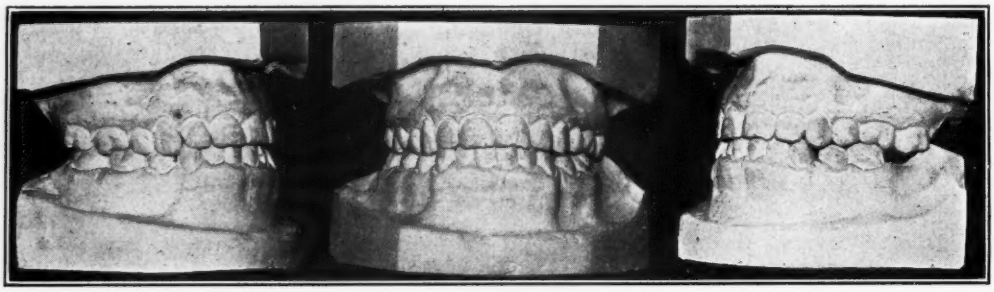


Fig. 29.

family, and the mother told about her experience in the hands of an orthodontist in New York City. The case must have been treated about forty years ago. She told me that she had outstanding eye teeth and the orthodontist removed four first premolars and placed appliances. He obtained the result which you see in Fig. 29, and which has always been maintained. Notice the fullness of the maxilla. If all the premolars had been retained that fullness would have been greater still, I am sure; and I do not believe the result by keeping all the teeth would have compared with the result which she has had all these years, and which has absolutely been maintained ever since. I believe the dentist did a great service for the patient by removing the first premolars. She lost a mandibular second molar, but that does not enter into the question.

Fig. 30 is also a case which was not treated by me. The child was eight or nine years old, and on one side the lateral incisor was in contact with the premolar. The arches were such that if the child had come to me I should have said that was a perfect case for expansion. As a matter of fact, the dentist started to treat the case but he gave it up, as he decided that the child would have a toothsome appearance if he kept all the teeth and straightened them, so he changed his mind. He removed all the appliances and extracted the four first premolars. That was rather radical I admit. I would not have done it

myself, and I do not believe any of you would have done it. But the patient matured, and Fig. 31 shows the result years afterward. The maxillary teeth are in good alignment, and the appearance is splendid from the front and sides and elsewhere. I think that if you could show an appearance like that on treated cases, you would consider that you had done the child a service. The interlocking of the various teeth is very good. One feature that is quite noticeable to me, and about which I should like to speak, is how the overbite has become diminished. Probably it is due to the vertical growth. The third molars erupting and assuming their proper position have accounted for the lack of overbite. I

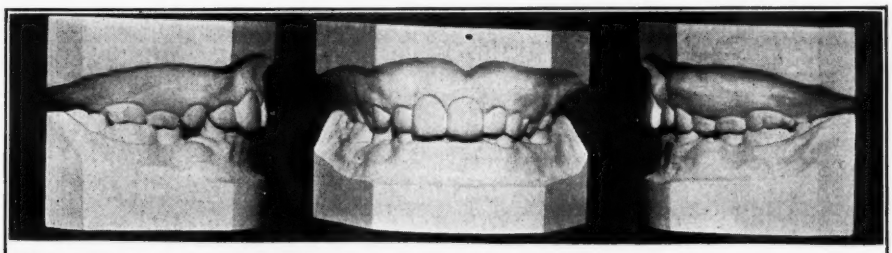


Fig. 30.

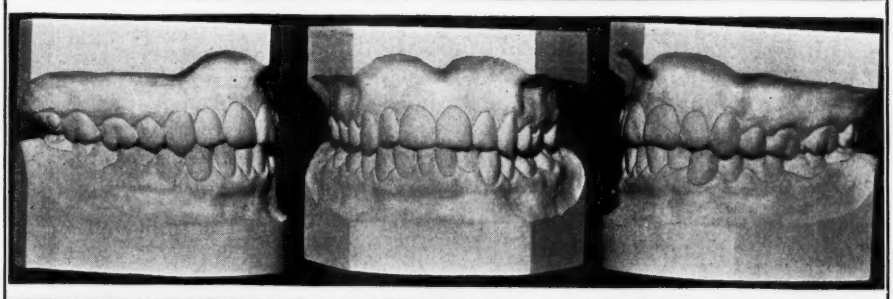


Fig. 31.

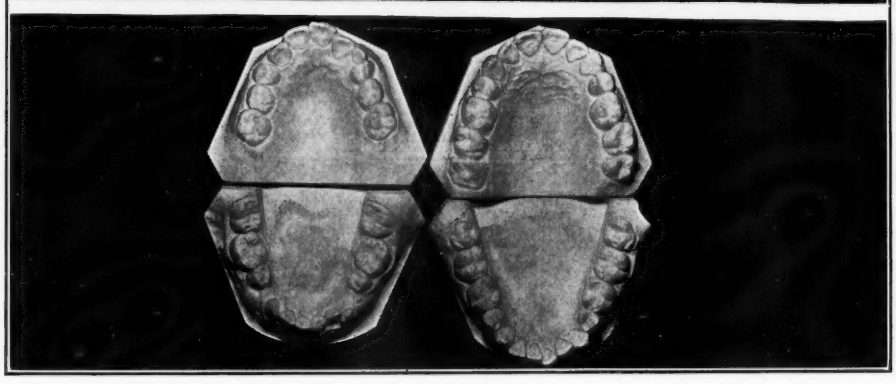


Fig. 32.

shall leave it to you to judge whether that child is better off without orthodontic treatment and with the extraction of the four premolars, than he would have been if he had had orthodontic treatment for a period of two, four, six, eight, or ten years, as it would have been necessary to follow the case. Fig. 32 shows the palatal aspect of this case. The mandibular incisor is outstanding, but we often see outstanding incisors in our treated cases, so that is not to be wondered at. This case did not have any treatment at all except for the first few weeks, and then all appliances were removed.

Fig. 33 is, perhaps, one of my oldest cases, 1900. It was a unilateral distal condition. In my opinion, this illustrates the non-infallibility of inflexible rules. I struggled with that case for some months trying to keep all the teeth. Dr. E.

H. Angle happened to be in the office, and I asked his advice. After seeing the case that I was struggling with, he said, "Dr. Howe, take out the first premolar and your troubles will be over." It seems almost inconsistent, but Dr. Angle knew that inflexible rules could not always be applied in orthodontia or in anything else. Rules are necessary to guide us and standards are necessary, but to adhere to an inflexible rule is not common sense, and Dr. Angle knew it. Within two months I was able to obtain a very acceptable alignment of the anterior teeth, and I have been fortunate in seeing this patient socially over a period of thirty-five years, so I know the result was permanent. Fig. 34 shows the same case in 1926. The overbite has remained the same, and the alignment has remained perfect. This case has been a success and a satisfaction to the patient. That satisfaction is the true test of our orthodontic cases, I believe.

Fig. 35 is a case that I showed before the Harvard Odontological Society in 1905. The child had a tendency to thrust the mandible forward so that it was

Fig. 33.

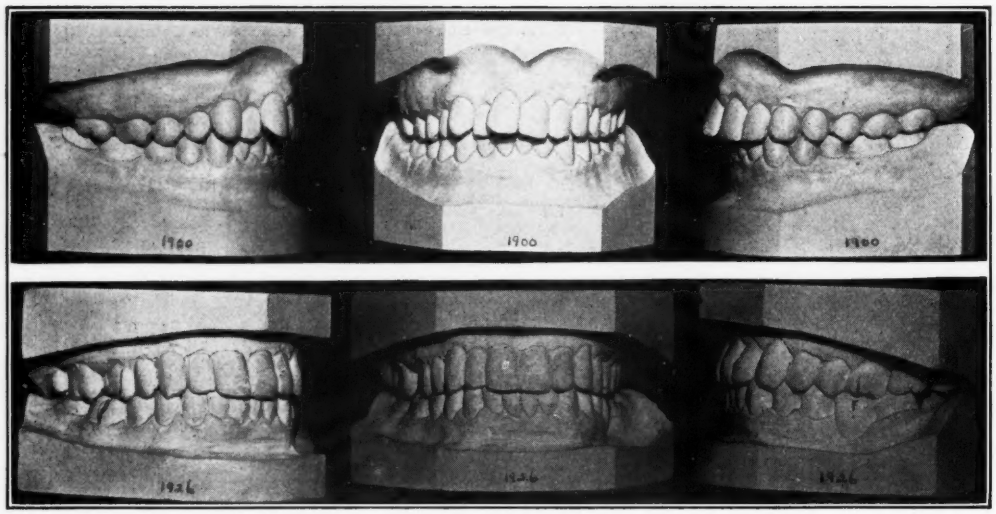


Fig. 34.

in front of the maxillary incisors. She had what might be called a Class III malocclusion. She could bite back, but did not bite back all the time. Both her parents had Class III malocclusions, and if this child had been left untreated and unnoticed, she doubtless would have developed a long mandible. But her physician noticed that there was something wrong about her face, so she came under my observation. I told the mother that if she would try to see that the child maintained her normal bite, as she could but did not do, perhaps we could bring her to a normal condition without appliances. She was only three and one-half years old at that time. The mother was very persistent and very conscientious and was able to get the child to bite correctly. Unfortunately, I do not have the models after thirty-two years, but I have seen her and her teeth remained in perfect apposition. Unfortunately, she was thrown from a horse only last month and was killed. However, I was gratified by the result and the permanency of the treatment. Had the child been left alone, I am positive that she would have developed a protruding mandible, because both parents had

Class III conditions. It is no imagination of mine to believe that that mandible has a forward thrust to it in Fig. 35. She was only two years old at that time. These pictures were shown in 1905, but I am showing them to you now to emphasize further that prevention, in my opinion, is the best treatment in orthodontia. Fig. 36 *A* shows the mandible thrust forward to a mesial relation to the maxilla; *B* shows the ultimate relation of the mandible to the maxilla.

Fig. 35.

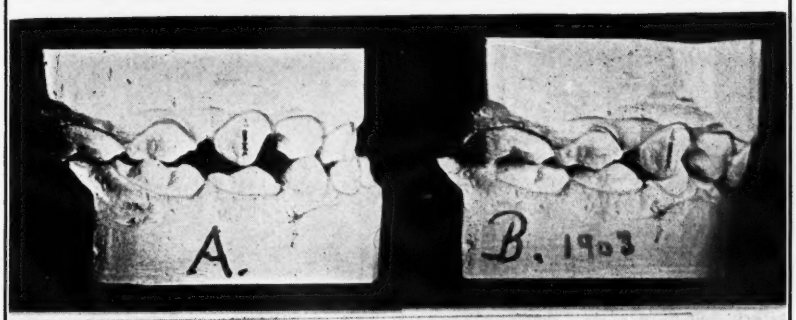


Fig. 36.

Fig. 37.

Fig. 37 is the same child when she was six years old, after the mandible was in its correct position in relation to the maxillary teeth. She maintained a proper normal occlusion all these years until her death a short time ago.

I want to add just a few sentences as a summary.

First, the necessity for orthodontic treatment often is the result of interference in the nutrition of the child, as evidenced by experiments on monkeys.

Second, with arrested development of the bones of the face and jaws there is often a disproportion between the size of the teeth and the size of the bone.

Third, to expand the jaws in all cases to conform to an inflexible rule is not logical, and when done may be comparable to a number nine hat on a number six head.

Fourth, the first molars are the natural keystones of the arches and should never be sacrificed when it is possible to preserve them in good condition.

Fifth, the hope of the future lies in prevention. The research workers of the present and the future will show us true values.

COMPROMISE TREATMENT IN A DISTOCLUSION CASE

NORMAN L. HILLYER, D.D.S., BROOKLYN, N. Y.

HISTORY.—The patient, C. S., came to me for treatment September 12, 1930. His history was as follows: Male, aged twelve years and five months, good hearing, vision, and mental development; weight 82 pounds, height 5 feet 3 inches, oral health good with fillings in all four first permanent molars. No other caries or fillings. Birth was normal, weight at that time being 8 pounds. Breast fed for six weeks, then bottle fed to eighteen months. Malnutrition, severe, until about one year. Father of English descent and mother of German; both had irregular arch form, as had an only sister. None were treated for malocclusion. Patient had "only mild forms of the usual children's diseases" according to the mother. Adenoids and tonsils in good health as reported by physician. No brothers, and only one sister. Thumb-sucking habit only partially broken up to date.

Etiology.—It seems that, in this case, the anterior alveoli supporting the anterior incisors were misplaced by the action and pressure of the thumb in the persistent habit of sucking. The bony structures were, perhaps, badly developed due to the early history of malnutrition, although this is not apparent at this date in other parts of the body.

Diagnosis.—Angle—

Class II, Division 1.

Lischer—

Distoclusion with protruding maxillary incisors.

Simon—

A. Bimaxillary, alveolar, anterior contraction, mild and symmetrical.

B. Maxillary, total protraction, severe and symmetrical.

C. Maxillary, alveolar, anterior attraction, severe.

Treatment.—The case being diagnosed thus, it was decided that general procedure should be set aside because of the severity of the dental anomaly and its effect upon the profile. To carry all the teeth of the maxillary arch distal to an extent great enough to relieve the protrusion of the maxillary anterior teeth and canines and to give a fair overbite, was thought too difficult, if not impossible, and of great risk of impacting the unerupted, developing third molars. It was, therefore, thought that a compromise, seldom necessary, was here indicated and that both maxillary first bicuspids should be removed and the canines and incisors carried distally to close the resultant spaces.

Presented to the American Board of Orthodontia and read before the New York Society of Orthodontists, New York, N. Y., Nov. 19, 1935.

The mandibular arch seemed to require no treatment, as the mesial drifting of the maxillary posterior teeth was to remain untreated and the distoclusion of the posterior teeth was to remain, even in the finished result. (Figs. 1-3.)

Therefore, on Oct. 3, 1930, one week after the extraction of the maxillary first bicuspids, a maxillary lingual arch of 0.038 wire was set, attached by half-

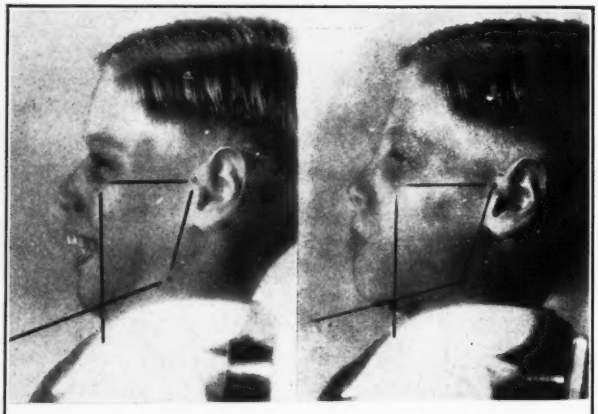


Fig. 1.

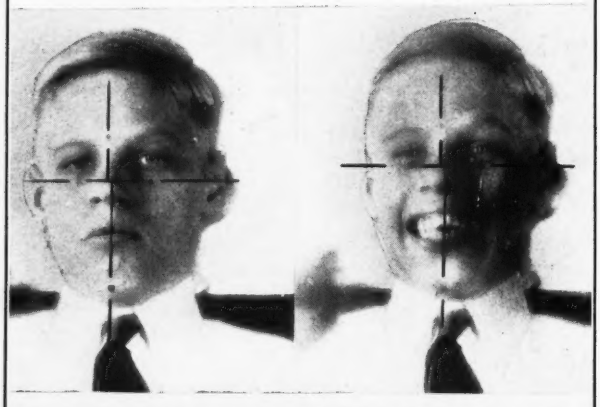


Fig. 2.

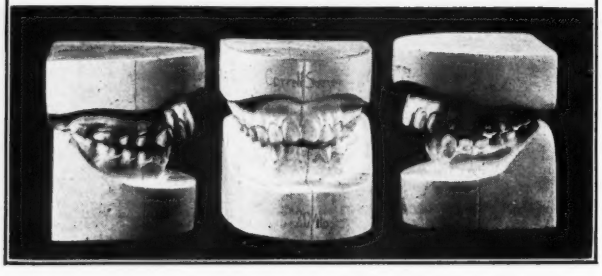


Fig. 3.

round tubes and locks to first molar bands, cemented to these teeth. The arch crossed high into the palate just mesial to the second bicuspid teeth and was to be kept passive during the entire treatment, for use only in stabilizing the molars.

On Oct. 24, Angle bracket bands were cemented upon the canines, and heavy silk intramaxillary ligatures were tied between their brackets and the distal ends of the flat buccal tubes. These ligatures were replaced and adjusted at intervals of two weeks until March 19, 1931, when, the canines being close to

the second bicuspids, Angle bracket bands were cemented on the lateral and central incisors, and an 0.025 round labial wire, with hooks at the canine regions, was placed in their brackets and in the molar buccal tubes. Silk intramaxillary ligatures were placed between the canine hooks and the molar tubes and adjusted every two weeks, except during vacation from July 13 to Sept. 10, 1930, when stainless steel wire ligatures were substituted.

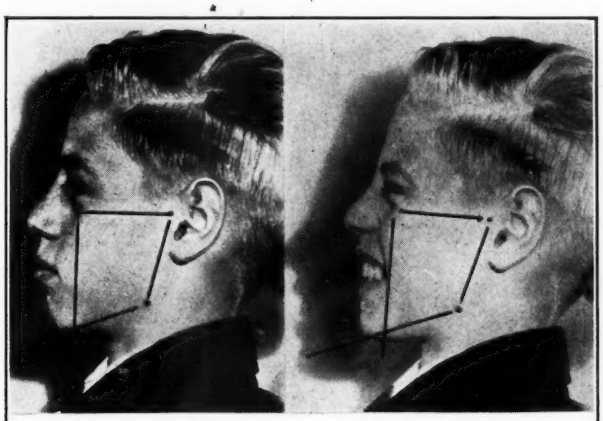


Fig. 4.

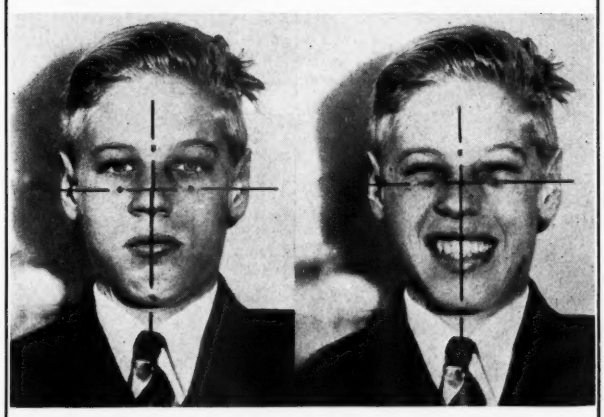


Fig. 5.

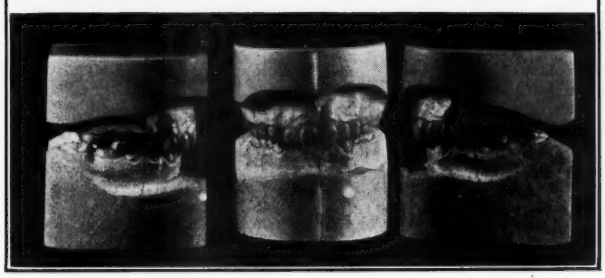


Fig. 6.

On Oct. 30, 1931, all appliances were removed, and an impression for a Hawley retainer was made. This was to maintain the progress made and to finish the closing of the spaces left by the thickness of the bracket bands. It was set in place on November 20, and its anterior wire of 0.022 gauge was adjusted on January 8, March 17, and May 26, 1932. The vulcanite lingual to the maxillary anterior teeth was cut away as the wire was adjusted.

The retainer was removed on June 17, 1932, and the case observed at varying intervals until Dec. 27, 1932, when models, photographs, and x-ray pic-

tures were taken, so that this case could be reported. Observation at six-month intervals will go on until either the mandibular anterior crowding and the spaces between the maxillary canines and the second bicuspids close, without treatment, or future treatment is decided upon. (Figs. 4-6.)

Prognosis.—Doubtful. If further occlusal adjustment does not correct the three above mentioned defects, further treatment may be necessary and will be instituted.

Results and Conclusions.—While this case is not reported as a definitely finished treatment, it presents some interesting features.

1. A compromise treatment involving loss of sound permanent teeth may be necessary and advisable. These cases are fortunately rare, having occurred only three times in my practice since its commencement in 1924.

2. In carrying incisor teeth and canines distal to the spaces resulting from the removal of the first bicuspids, it has been found best, in my hands, to carry the canines distally first and then the four incisors.

3. In connection with the removal of maxillary bicuspids Dr. Leuman Waugh has shown me that it is better to remove the second bicuspid rather than the first, even though more teeth must be moved distally. He states that, as the fibers of the peridental membrane run from the mesiobuccal surface of the first bicuspid to the distolingual surface of the canine, these fibers should not be severed by extraction of the first bicuspid. If such severance is made, the force of occlusion in the maxillary arch at the canine will cause a spacing between the canine and the second bicuspid. If, however, the second bicuspid is removed, no such force is present and no spacing occurs after treatment to close spaces between the first bicuspid and the molar.

While this is the only case in which I have observed spacing distal to the canine after similar extraction and treatment, it is present here and perhaps Dr. Waugh's explanation covers the reason.

I feel that, notwithstanding the doubtful prognosis and only partial results of this case, enough has been already accomplished to make its treatment worth while from all angles. I feel, too, that such treatments should be reported more often, since they may contain something of value either in what has been done or what has been left undone or done incorrectly.

TISSUE DEVELOPMENT INCIDENT TO ORTHODONTIC TREATMENT*

EARL W. SWINEHART, D.D.S., F.A.C.D., BALTIMORE, MD.

THE case to be reported is one that fortunately is rare, but it seems to possess more than the usual number of points of interest to the orthodontist and the surgeon. Its history illustrates the necessity for well-considered diagnosis and prognosis and portrays a record of both operative failures and successes. While it clearly shows one of the limitations of orthodontia, it also demonstrates an unusual way in which the technical procedures of that science may be utilized for the relief of human beings if they are applied with biologic understanding. It also seems to prove the premise of the title of this report that mechanical stimulus can initiate and be mainly responsible for considerable development of both bone and soft structures; that within biologic limits the amount of development that may be induced depends not only upon the varying vitality of individual cells, but also upon efficient methods by which the requisite mechanical stimulus may be intelligently applied. In the usual orthodontic case, which is treated during childhood or adolescence, it is often impossible to differentiate between the effects of mechanical stimulus and inherent growth, but this case was free from that confusion as treatment was carried on long after the normal growth period was passed.

The patient was a woman thirty-five years old when she first presented for advice. Fig. 1 illustrates the original models of the case. The models show that the teeth, except for the maxillary right cuspid, were in very good occlusion. Several weeks previous to consultation, the much resorbed crown of the deciduous cuspid was exfoliated and the cusp of the permanent tooth protruded beyond the gum to the extent shown.

Fig. 2 *a* shows one of the original roentgenograms of the area. It will be noted that the permanent cuspid was of average size and form and in favorable eruptive position. It was not impacted between the adjoining teeth, and there seemed to be almost adequate space to permit its coming into correct position in the arch. It will also be noted, however, that there was unusual density of bone adjacent to the tooth and what seemed to be almost complete elimination of the peridental space anterior and posterior to the root. Whether the same condition obtained on the labial and lingual sides, of course, could not be determined by roentgenogram.

Prognosis was doubtful. The favorable eruptive position of the tooth, when considered with the unusual conditions of the surrounding bone, indicated that there had been a period of eruption which had ended in ankylosis. Thinking, also, that it might be one of those rare instances in which eruption is delayed years beyond the normal age, the conservative view was taken that the tooth should be given every opportunity to erupt before incurring the hazards of extraction if it were completely ankylosed.

*A case report presented before the New York Society of Orthodontists, November 19, 1935.

Accordingly a lingual appliance was adjusted with finger springs to widen and maintain the space between the incisor and the premolar. As no progress in eruption was noted, a screw hook was set into the lingual surface of the cuspid and force was applied occlusally as in Fig. 2 *b*, but with no better results. Strong intermaxillary force exerted from a mandibular labial appliance was then applied directly to the tooth for several weeks. As not the slightest movement was noted, the appliances were removed and treatment was abandoned. That tooth certainly did demonstrate one of the limitations of orthodontic measures. The patient was referred to a general practitioner as being beyond orthodontic aid because of ankylosis.

Believing that decay and possible serious consequences might result if the exposed tooth were left under a bridge, the dentist decided upon extraction. The result of that operation was unfortunate. It was found that there was firm osseous union to the entire surface of the root, and removal of the tooth was effected only after all of the surrounding tissues had been sacrificed.

Fig. 3 shows a fairly accurate model of the condition five weeks after the operation. The impression was made with plaster in the usual manner after the wound had been nearly filled with cotton, the exposed surfaces of which were heavily coated with vaseline. About $\frac{1}{16}$ inch of the periphery of the wound was left exposed to the impression material.

The gap in the ridge exceeded in every direction the size of the tooth removed. One can easily see the amount of tissue sacrificed by viewing the model. The wound was particularly unsightly, as the upper lip was habitually lifted high in smiling and laughing. Speech was interfered with as though there had been a partial cleft of the palate.

In the effort to repair or at least to minimize the damage that had been done, two of the usual methods of correction were considered: plastic surgery and prosthesis. The plastic surgeon consulted did not view an operation with favor. It was his opinion that placing a bone graft and filling in with flaps from the neighboring tissues would require at least two operations, with long hospitalization and much suffering by the patient; that it would be necessary to take the large labial flap from the inner surface of the upper lip which probably would change its shape and cripple its action; and particularly that there would be great danger of infection and ultimate failure. The idea of a prosthetic restoration that would fill the gap in the ridge and carry an artificial cuspid was dismissed. Such a substitute would have corrected the speech defect, but would have been unsightly and bothersome to the patient.

As no other means seemed to promise the same degree of success, it was decided to make an effort to close the gap through orthodontic measures by carefully moving the first premolar tooth forward into the cuspid position. As the result of considerable observation of the ready response of adult tissues to mechanical stimulus, there was strong hope that the tissues posterior to the gap could be developed the required amount. It seemed advisable to try first a tipping movement and, if later justifiable, to correct the vertical relation by anterior root movement.

Accordingly a Mershon type of lingual appliance was used to maintain the form of the arch, hold the lateral incisor in position, and provide a base

for a fine gauge loop spring which exerted force anteriorly against the neck of the premolar tooth. Movement was carried on cautiously and checked with

Fig. 1. Fig. 2.

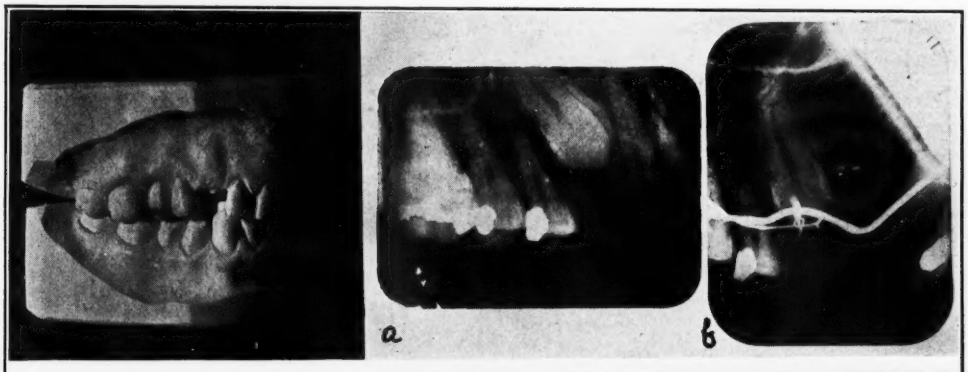


Fig. 3.

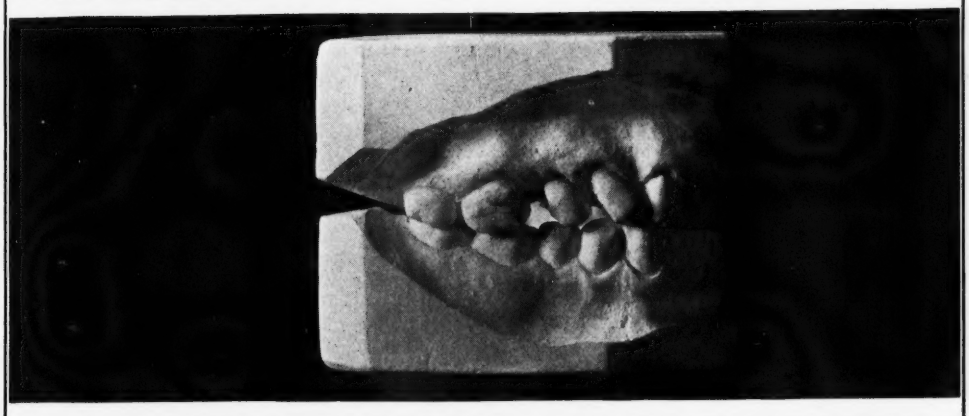


Fig. 4.

Fig. 5. Fig. 6.

x-ray films. Progress was soon apparent as the gap began closing throughout its entire extent as the posterior wall moved forward to meet the anterior one. In fifteen months the premolar had been carried forward into contact with the lateral incisor. By that time, all evidence that remained of the gap

from the labial aspect was a fine crease, the walls being in such close apposition throughout that only a fine thread could be passed between them.

Fig. 4 illustrates the progress of the case. At that point, the plan of treatment was changed. As the main objectives of treatment had been gained, it seemed a more rational procedure to establish soft tissue union and then to tip the tooth back to its original position, which could be done easily and safely, rather than to undertake the long and hazardous root movement.

With the premolar held in contact with the incisor, the walls of the gap were thoroughly scarified, and the labial and lingual edges were drawn together by sutures. These sutures probably were of little value as the sides healed together promptly by first intention. A month's time was allowed to permit the union to become strong, after which the loop spring was removed, and the tooth was allowed to drift backward. As there was no evidence of the union yielding, the tooth was then tipped completely back into its original position. The dentist next bridged the cuspid space, attaching the porcelain tooth to the premolar by means of an inlay. In order to minimize the stress upon the premolar, the artificial tooth was not allowed to occlude with the mandibular teeth.

Fig. 5 shows models of the final results. All evidence of the injury has been erased upon the labial side except for a shallow depression in the region of the cuspid root. By the length of the porcelain tooth, it is seen that there is but slightly more depression in the crest of the ridge than is found after the usual loss of a tooth. The palatal view shows that repair of the injury in that region was not complete but sufficient to be unnoticeable by the patient.

Fig. 6 discloses the amount of bone that was still absent when treatment was completed. The space is doubtless filled with connective tissue, and the absence of the bone in that region seems to be of no practical consequence. Two years after completion of treatment the premolar remains as firm as the corresponding teeth in the arch. Roentgenograms indicate only slight addition of osseous tissue, if any, but they do show normal density of the bone in the premolar region.

It would have been interesting and valuable to know whether the gap in the bone would have been reduced or closed if the root movement had been accomplished. Doubtless there would have been considerable development of new bone, as it is evident that more bone did develop between the molar and the first premolar to allow the latter to make contact with the lateral incisor. Otherwise that could not have occurred except by much extrusion of the tooth from its socket. Had that been so, the tooth would have shown great looseness and likely would have been devitalized. At no time was there more looseness than is found during usual orthodontic movement, and normal vitality was shown by the considerable pain that was experienced during preparation of the cavity for the inlay.

EARLY TREATMENT OF MALOCCLUSION

HARRY W. PERKINS, D.M.D., BOSTON, MASS.

THE objective of these case reports is to focus attention on the treatment of malocclusion at an early age. Parents are ill advised by misinformed physicians, dentists, and others so that treatment is delayed until their children are twelve to sixteen years of age. The children then present the typical gross malformation commonly seen at that age. Most of my early cases were of that type, and I learned from them how almost impossible it is to finish a case to conform to the ideal of occlusion, of profile, of facial contour, and of function, as taught by Angle and others, to be correct orthodontia. Between the ages of twelve and sixteen years, it is too late ever to hope to *rebuild the malformed features* most of these unfortunate children have acquired through their growing years.

I became impressed with the fact that the tooth relationships are the visible evidence of a very general malformation of the entire face, and that the tendency to this malformation must have started very early in life, in many children before the age of one year, and in a large percentage of cases is progressive and may become gross.

All the evidence I have obtained indicates that at least 75 per cent of the malocclusions we see, from the ages of twelve to sixteen years, was present in that individual and could have been diagnosed at the age of six years or even before. When so diagnosed and treated between the ages of four and eight years, most cases are finished before the patients are ten years old.

Expansion is obtained, the erupting incisors are guided to their correct positions, and the child at eight or ten years of age has a balanced occlusion, appropriate to the age, which proceeds to develop without the assistance of wires, to a condition more nearly conforming to Angle's ideal.

Some further advantages of early treatment are: no appliances have been attached to the permanent teeth. Because no real deformity has been allowed to develop, the uncertain factor of perfect cooperation in muscle training and exercise is largely eliminated; there is no real period of retention; there is minimum interference from school or social activities; and almost no complaint from the children, in fact, most of them have forgotten that they have ever worn wires.

These three cases were treated on this basis. I shall not go into the detail of appliances other than to say that the pin and tube appliance and the removable lingual wire were used in all cases, using the second deciduous molars and deciduous cuspids for attachments. This type of appliance was chosen because of its flexibility and adaptability to the deciduous arch. None of the cases were complicated by any impaction, missing or supernumerary teeth.

In Fig. 1 the model on the left is the original one of a boy five and one-half years old, with the maxillary incisors well locked posterior to the mandibular

Read before the New York Society of Orthodontists, New York, N. Y., Nov. 18, 1935.

incisors. The anteroposterior relationship of the cuspids and molars was just beginning to show the influence of this condition toward prognathism. The profile suggested it but only in the lips, because no real basic changes in the mandible had occurred at this time. The model on the right was made eleven weeks later and shows the balanced occlusion appropriate to the age I spoke of before. At this time all the wires were removed, and the mandibular wire was never replaced. In October, 1922, it became necessary to replace the maxillary lingual wire to guide the erupting incisors, and treatment was discontinued the following March. The boy had eight appointments during this period of six months, and received no further treatment.

Fig. 2 shows a side view of the original model and a side view of the same case later at eight years of age. I regret that family troubles shortly after this model was made took the boy out of my territory.

Fig. 1.

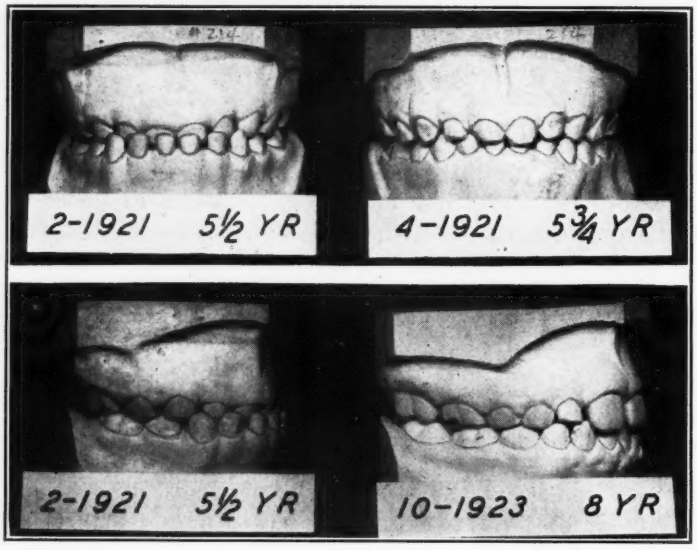


Fig. 2.

Fig. 3 shows models of a boy at six and one-half years and again at eighteen and one-half years. This case was treated for the following reasons: arch measured 24.3 mm.; no spacing of deciduous incisors; overlapping mandibular incisors; the mandibular central incisors are the permanent incisors and show a strong tendency to occlude in an anterior position.

Male members of the whole family had prominent chins; two other children in the same family had a similar condition, more advanced, with the maxillary incisors in posteroclusion. Case was completed in two years and three months, requiring fifteen appointments the first year, thirteen appointments the second year, with no visits during July, August and two-thirds of September either year. With this type of appliance it is safe to allow children to be away two or three months without attention.

Fig. 4 shows the occlusal view at six and one-half years and at eight and one-half years. At this time I had obtained 6.2 mm. expansion and the boy had a balanced occlusion for the age.

Fig. 5 shows the same case at six and one-half, twelve and one-half, and eighteen and one-half years. The patient received no treatment after he was nine years of age.

Fig. 6 shows one result of early treatment, nearly ten years after active work was discontinued.

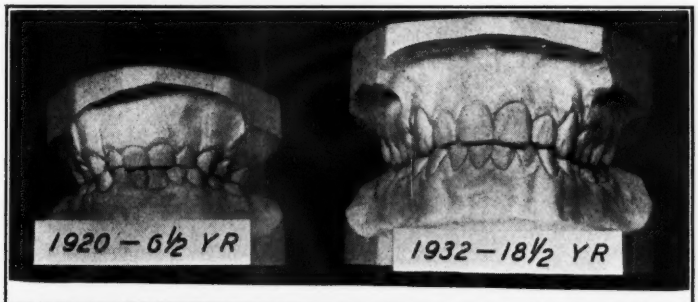


Fig. 3.

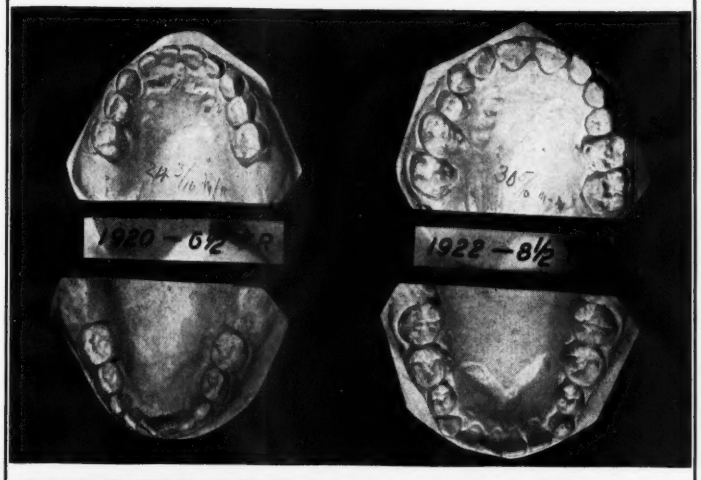


Fig. 4.

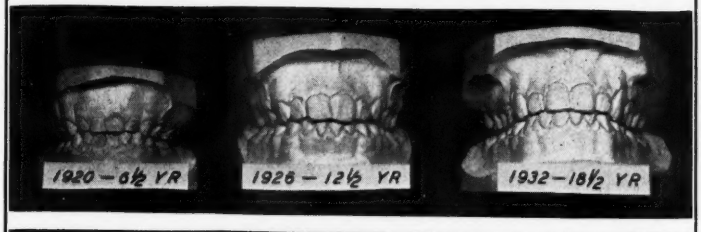


Fig. 5.

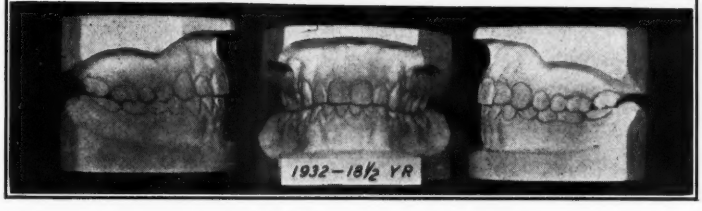


Fig. 6.

Fig. 7 shows models of a girl six years old. No cause was determined for this unilateral distoclusion, with retruding incisors; the arch was very narrow measuring only 25.5 mm. between the second deciduous molars. There was no spacing between the incisors. She was one of three children in the same family having this unilateral condition.

Her older brother had, in addition, a lingual occlusion of this same side, lateral incisor to first permanent molar, inclusive. I believe this type of case to

be the one that when not treated at an early age later develops the outstanding detached lateral incisor that many of us have retreated several times in our effort to hold it in proper position.

Fig. 7.

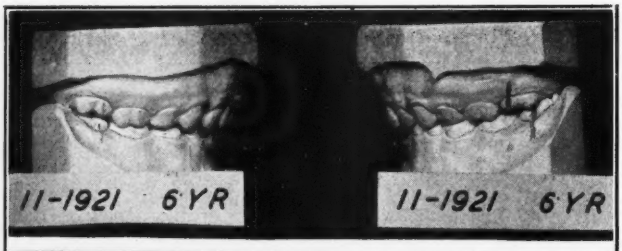


Fig. 8.

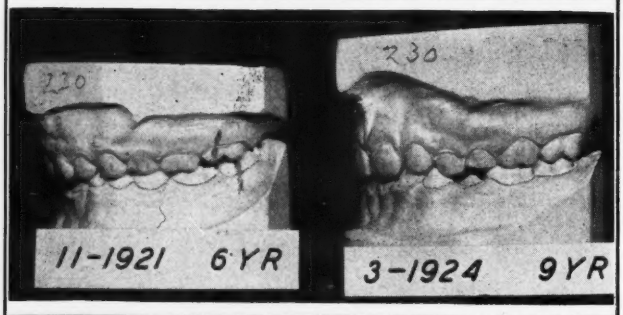


Fig. 9.

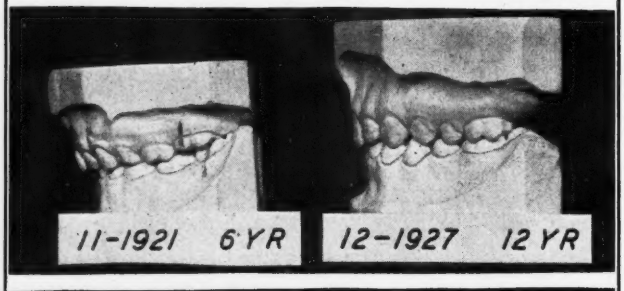


Fig. 10.

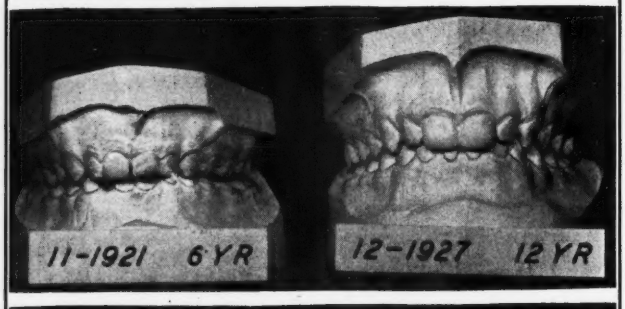
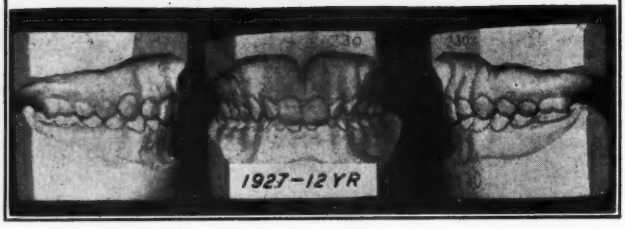


Fig. 11.



The case was completed in twenty months with an average of one and one-half visits per month. This balanced occlusion at nine years of age (Fig. 8) proceeded to develop in a normal manner, without treatment, as Figs. 9-11 show.

MANDIBULAR RETAINERS WITH INCISOR SPRINGS AND AN APPLIANCE DESIGNED TO ASSIST IN BREAKING TONGUE HABITS

GEORGE M. ANDERSON, D.D.S., BALTIMORE, MD.

IT HAS been difficult to maintain the mandibular incisors in even alignment. The ordinary removable retainer, Hawley type, made of vulcanite is not worn as much or as long as we desire by many of our patients. When the in-

Fig. 1. Fig. 2.

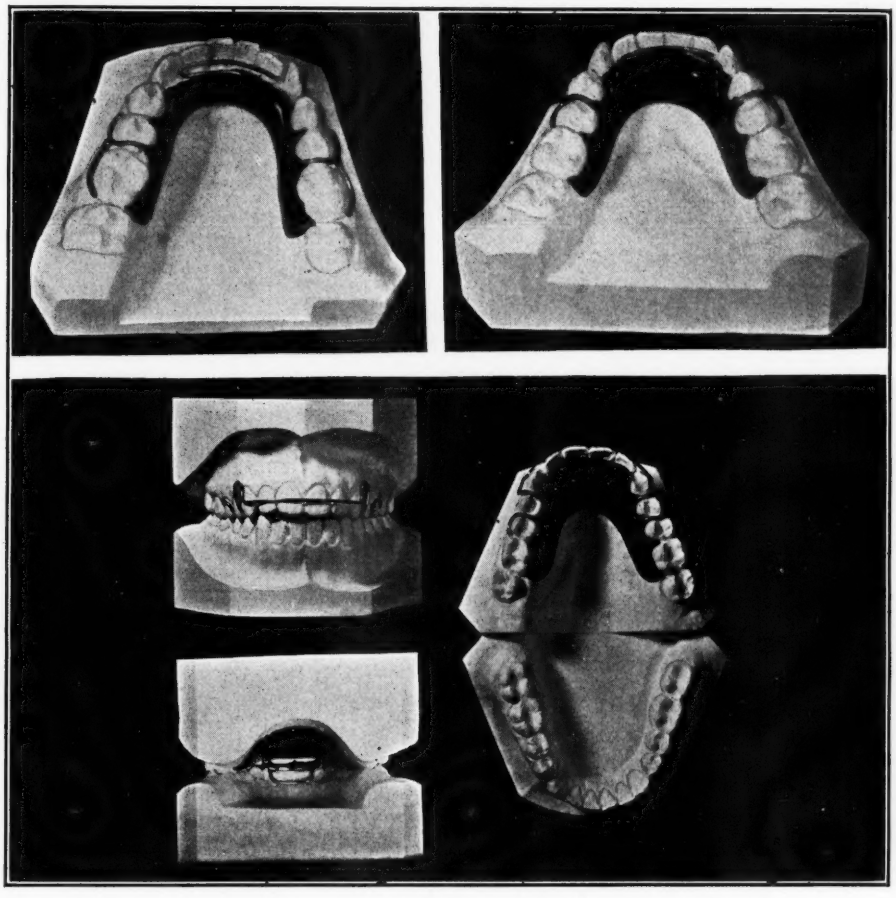


Fig. 3.

cisors slip a little lingually or bunch, the vulcanite being inadjustable and unyielding in adaptation causes soreness if an effort is made to force it into place so that the incisors may be restored to their former normal position. To overcome this we have made all mandibular retainers with incisor springs, usually of 0.030 wire. (Figs. 1 and 2.) If a slight relapse in the position of the

Clinic given before the Southern Society of Orthodontists, Chattanooga, Tenn. January 27, 1936.

incisor occurs, adjustments in the springs are easy, and the retainer becomes an active working appliance; and, when the necessary movement has been accomplished, the retainer again is worn exclusively to maintain tooth position.

We have also had considerable difficulty in overcoming tongue habits. A small removable plate, Hawley type, is used with a fence of round wire, usually 0.036, extending from the palatal vulcanite to the lingual gingival margin of the mandibular incisors. (Fig. 3.) This has served well, for it actually interferes with the placement of the tongue between the incisors and against their lingual surfaces. Since it is removable, it does not interfere with eating, is not uncomfortable, and seems to have no effect on speech.

PARASYMPATHETIC DOMINANCE AS A CAUSE OF MALOCCLUSION*

F. W. Broderick, M.R.C.S. Eng., L.R.C.P. Lond., L.D.S. Eng.

A YEAR or so ago Mr. Robert Cutler read a paper before this Society entitled "Postnormal Occlusion as a Manifestation of the Lymphatic State." I was not a member at that time and was not present to take part in the discussion which followed, but there was so much in the paper with which I was in agreement that when he asked me to contribute something to this meeting, I felt that I should like to reopen the subject once again, giving it, perhaps, a wider background.

I present this paper with some diffidence, in that I appreciate my ignorance of the subject of orthodontics as it appeals mostly to the members here; nevertheless, possibly I may be able to interest you by presenting a new approach to the etiology of those conditions which it is the purpose of this Society to study: an approach built upon the study of biochemistry and biophysics, the teachings of which I have attempted to correlate with dental pathology.

Mr. Cutler built up his argument, in the paper mentioned, along the lines of inherited diathesis, as something giving a special type of metabolism to an individual, the consequences of which were to bring about a certain well-recognized deformity of the jaws which resulted in postnormal occlusion. He described the characteristics of the child—the subject of this diathesis—and then proceeded to show that a large proportion of children with postnormal occlusion were of this particular type.

Now, I have interested myself in this matter of constitution and diathesis for a number of years and have considered it in its relation to the etiology of the common dental lesions of caries and of pyorrhea. Since reading Mr. Cutler's paper I have taken note of those cases of postnormal occlusion which have come my way, and have noticed that, in a very large proportion of the comparatively small number of cases which I have seen, the teeth which the children possessed were extremely good; in fact, there would seem to be a definite immunity from caries in cases of postnormal occlusion. If this is indeed true, and if there is any truth in my hypothesis as to the cause of dental caries, which I shall presume is well known to you, then this fact might possibly be an important guide to the etiologic factors which bring about this condition.

Mr. Cutler dealt only with end-points, the beginning and the ending, the lymphatic state and the malocclusion; he made no attempt to explain the cause of the former, the underlying causative factors on which the metabolic inefficiency rests, nor to trace the production of the maldevelopment of the jaws in relation to this inefficiency. I agree, as did a number of the speakers on that occasion, that there is a definite connection between the two states, and should like to take this opportunity of placing before you my ideas as to the causation of the diathesis, in the first place, and to suggest how, possibly, this might be

*Transactions of British Society for the Study of Orthodontics, 1934.

productive of the changes in the dental apparatus which eventually come about. In the course of this discussion it may be possible to throw some light upon the seeming exceptions which were so stressed by the opponents of Mr. Cutler's hypothesis.

I have brought to your notice this evening an ultramicroscopic blood picture, demonstrating the colloidal protein particles of the blood plasma. These constitute the matter primarily concerned in the processes of metabolism, the interchange taking place at the interfaces of the colloidal particles, and as the chemicophysics of matter in the colloidal state is probably unknown to the majority, perhaps I may be allowed to give just a brief summary as an explanation of that picture.

All matter in dispersion is either in solution—that is, in molecular dispersion or in coarse dispersion—or in the colloid state, the difference depending upon the size of the particles. Sugar dissolves in water and is an example of molecular dispersion; sand does not dissolve and slowly settles out, the particles precipitating and falling to the bottom of the vessel holding the water. Between these two types of dispersion lie limits within which matter is neither in solution nor in precipitated particles, but is present in minute dispersion in what is known as the colloidal state. Quite arbitrarily the size of a colloidal particle has been fixed as being between 0.1 of a micron and 1.0 of a millimicron, a micron being 1/1,000 of a millimeter. The colloidal particles, therefore, lie within the limits of 1/10,000 and 1/1,000,000 of a millimeter. Particles of this size are invisible under the highest power of a microscope, but they are too large to pass through the pores of a parchment membrane: they are, however, visible with the ultramicroscope, which differs in principle from a microscope in showing not the particles themselves, but their reflected images. The principle of the ultramicroscope is, in fact, demonstrated by the beam of light passing through a hole in a window blind and falling into a darkened room. You are all familiar with the particles of dust which this makes visible, but what you are seeing are not in reality particles of dust, which are invisible outside the limits of the ray, but their reflected images.

Matter in molecular solution is invisible even with the ultramicroscope, and the particles are small enough to pass through a parchment membrane, this constituting matter in the crystalloid state, as differentiated by Graham; on the other hand, matter in coarse dispersion has particles which when not visible to the unaided eye are visible under an ordinary microscope.

Thus we see not only that there are three kinds of matter in dispersion, but that with matter in the colloidal state itself we may have particles of different size within the limits in which this state is possible.

Now, matter in this form possesses certain chemicophysical characteristics which differentiate it from all other, to which are due all the possibilities of life; in fact, life is only possible through the colloidal state, all living matter being colloidal, and as soon as it ceases to be so, death supervenes. Schade says: "The physicochemical investigation of the human body extends far beyond the cellular pathologic concept of Virchow.

"As in the case of all branches of biology, medicine, thanks to the quickening influence of colloidal chemistry, is on the verge of a new era. Medical re-

search has broken a road for itself in still another direction; instead of the earlier humoral pathology, which explained all disease upon the basis of a disturbance of the 'humors,' there arose a cellular pathology, as a consequence of the development of the microscopic technic, according to which the cell was regarded as an entity controlled by its own laws, whose independent behavior was etiologically determinate. To this conception we could apply the old principle of Virchow: 'If the matter is to be understood and the details grasped, nothing remains but to go back to the elementary constituents; and the elementary constituents for the chemist are atoms, for the physicist, molecules, and for the biologist, cells.' Now behind the cell we find the micellæ as part of a colloidal system, so nothing remains but to go back to them. Everywhere in the body, in the cells, in intracellular tissue, in the blood, in the body fluids, are found colloids; practically every process bears the imprint of their individuality. Striking new results of far-reaching importance have led a not inconsiderable number of physicians to believe that in colloid research lies the key to profound penetration of the mysteries of etiology. The vivification of medicine by colloid chemistry justifies us in calling this a new era in medicine.''

The chief importance of matter in the colloidal state in the living body lies in the enormous development of surface area which it brings about. In much the same way as the tree develops surface area by the output of its leaves, so that a single large tree in full foliage in reality covers many acres of surface, so the body of a single person, on account of colloidal dispersion, would cover square miles of area at the intersurfaces of which energy production comes about. Consider the surface of a cube of metal, each surface of which is 1 cm. square, giving thus 6 sq. cm. If this were divided into smaller cubes with sides of 1 sq. mm. the whole surface area would be 60 sq. cm. If it were subdivided into a billion little cubes of a thousandth of a millimeter, or 1 micron to a side, the total surface area would be 6 sq. meters, and still it would be a coarse dispersion and not colloid. If subdivided into millionths of a millimeter, which would be within the limits of matter in the colloidal state, the surface area would be roughly an acre and a half.

In addition, however, to the enormous increase in surface area, and the number of interfaces which the colloidal state makes possible, certain other characteristics are inherent in particles in this state of dispersion, the most important of which is that of the power of adsorption of ions from the medium in which they are dispersed, through which the processes of metabolism, the turning of food into energy, are brought about. We have to consider not the colloid micellæ as separate and distinct things, so much as the relation of these micellæ to the medium by which it is surrounded, any change in this medium immediately affecting the character of the micellæ themselves, and through change in surface tension, enlarging or diminishing their size and characteristics, and therefore their metabolic possibilities.

We have seen that the colloidal state may exist with particles differing in size from that of 1/10,000 to 1/1,000,000 of a millimeter. In this difference lies the story of constitution and diathesis. As the particles approach the size of true solution, in molecular form, at one extreme, or those of a coarse disper-

sion at the other, which will depend entirely upon the constitution of the surrounding medium, so will alter the whole character of the individual, metabolic, chemical, physical, and psychologic.

The colloidal particles have been compared, by analogy, with solar systems; in the center, as representing the sun, lies a positive electrical charge, the proton, around which revolve the satellites, held in position by varying degrees of attraction; these are formed of the adsorbed ions. In the outermost orbit lie electrons, particles of negative electricity; next in position lie the inorganic salts, next sugar, then urea and uric acid, followed, still from without inward, by the amino acids and the fat. With perfectly functioning particles all these constituents are firmly held to the nucleus, but under certain conditions they tend to pass out of the colloidal complex, loose, as it were, into the surrounding medium, as the adsorptive power of the particle diminishes. When the colloidal complex tends to break up in this manner, as the result of changes in the dispersal medium, away come the constituents from without inward according to the amount of disturbance, the particles tending to get progressively smaller until they eventually go into true solution. On the other hand, the particle may enlarge, due to changes in surface tension, when they will hold their constituents still closer, adsorbing more from the surrounding medium, in which case these latter may even tend to disappear from the blood plasma, and, being changed from crystalloid into a colloid state, will be incapable of being differentiated by ordinary analysis. This is the explanation of such conditions as hypoglycemia or hypocalcemia, on the one hand, and of hyperglycemia and hypercalcemia, on the other. Further, as the particles enlarge, the total surface area diminishes and metabolic processes slow down.

As, when particles get smaller in this way and lose their adsorptive powers, they give up water, and when they enlarge and increase their adsorptive power they take in water, McDonagh speaks of them as dehydrated and hydrated particles.

In this way we get three kinds of colloidal particles: the normal, that is, as small as is consistent with the colloidal state, giving a normal adsorptive power and enormous surface area; the dehydrated particles, still small but not perfect particles in that they have lost adsorbed constituents; and the large, hydrated, particles with increased adsorptive power, and lessened surface area. These can be differentiated with the ultramicroscope, as they also offer other differentiating signs, with which we have not time to deal here.

I have said that the characteristics of the colloidal particles depend essentially upon the constitution of the dispersion medium in which they lie. The chief changes in this will be its reaction, the amount of hydrogen ions which it contains, designated its pH; the proportion of ions of the monovalent and the polyvalent salts, mainly those of sodium and potassium, on the one hand and of calcium and magnesium, on the other; on the balance of circulating hormones, and of the autonomic innervation of the tissues, whether this be primarily through fibers of the sympathetic or of the parasympathetic. Further, as this innervation is antagonistic, the one stimulating to activity and the other inhibiting any particular function or organ, according as to whether it is conservation or expenditure of energy which is necessary at the time, it will be

seen that the whole colloidal system, i.e., the particles themselves and the intermicellary liquid, will be constantly in a state of change, alternating backward and forward according to the necessities of the moment.

Now all these circumstances taken together, the pH of the tissues, the ionic balance, the hormonic balance, the nervous innervation, and the state of the colloid particle, all reacting the one with the other, make up what is known as the vegetative system, on which depends metabolic activity.

It will be within your knowledge that I have fathered the hypothesis that the dental lesions of caries and of pyorrhea depended ultimately upon vegetative balance. It is true that when I commenced thinking upon these lines I considered only the matter of tissue reaction, acidosis, on the one hand, and alkalosis, on the other. As my knowledge grew, however, I appreciated the fact that this could be only one part of the story, that these conditions, clinically at any rate, represented only symptoms, themselves dependent upon other circumstances. This observation carried me back to the autonomic nervous system associated with hormonic influences; here again one found that one had not reached bedrock. It was still necessary, following Virchow's method, to get back to elementary constituents, so I took up the study of colloidal chemistry, which united all these factors which I had previously considered into the vegetative system as conceived by Zondek and Krous. Farther back than the colloidal system it is impossible to go, for these are the ultimate particles of life.

Now vegetative imbalance, designated sympathetic and parasympathetic status, or dominance, and including not only excessive sympathetic or parasympathetic innervation (as visualized by Eppinger and Hess) but the whole matter of colloidal disquilibrium: reaction, ionic, and hormonic imbalance, becomes the basis of diathesis or altered constitution, giving the fundamental threshold not only to dental, but to all general and systemic, disease through changes in metabolic efficiency, primarily through capillary reactions and permeability which this will bring about. Here we get, not only why, but how, the recognized changes take place.

Ramsey, considering the onset of disease, says: "Biochemistry and biophysics have taught us that the living body is an admirably equipped laboratory in which nature is continually performing experiments. When they are successful we are not conscious that anything is happening, everything goes like clockwork, and we feel in good health. When, on the other hand, the experiments fail we become aware of unpleasant sensations, which we have learned to recognize as symptoms of disease. Health, therefore must be considered as a dynamic rather than a static state. We keep healthy as the result of a perpetual struggle to maintain physiological equilibrium in the reactions constantly taking place between the cells of the body and the nutrient capillaries. Physicochemical changes, therefore, which originate in the capillary system, are the first departures from health, and the cause of the earliest symptoms of disease.

"The part played by the capillaries is quite distinct from that played by the heart and the other blood vessels, all metabolic interchanges taking place through their walls; consequently they form the most active, purposive, and dynamic part of the vascular system. Their contractility is controlled not only by the vasomotor nerves, but also by chemical stimuli, the former acting as

a coarse, the latter as a fine, adjustment. The capillaries are not simple tubes through which blood flows. They do not respond to the amplitude of the pulse-waves in the arteries. They are really a constituent part of the tissues in which they lie, and their blood circulation is regulated and controlled by the requirements of the individual cells of the structures which they supply. All the important business of life is transacted through the walls of the capillaries.''

Now, capillary activity is controlled by the vegetative system, as we have just considered, the sympathetic status representing a state of tissue activity with contracted muscle fibers, and therefore with contracted capillaries, with diminished permeability of the capillary walls, calcium accumulation within the cell, increased acid formation, increased thyroid and adrenal activity, and a dehydration of the colloidal particles of the blood plasma; whereas the parasympathetic status represents just the opposite: muscle relaxation, dilated capillaries with increased permeability, calcium dissimilation, alkaline reaction, diminished activity of the thyroid and the adrenals, and an hydration of the colloidal particles. Thus, although it must be appreciated that these are constantly interchanging the one with the other in the processes of life, sympathetic being replaced by parasympathetic activity, it will be seen that with a constitutional, inherent tendency to overactivity of the one or the other, one set of functions, catabolic or anabolic, will, in some degree, tend to overbalance its antagonist, giving a definite trend to individual metabolism. In this way we get a glimpse of individuality, in health or disease, as set by vegetative balance or imbalance. But it is not quite so simple as this might seem to suggest; in practice it never is, for although it is easy to conceive extreme cases of sympathetic or parasympathetic predominance affecting every organ and tissue, this rarely eventuates. With sympatheticotonia it is much more common to have the whole of the body affected at the same time, as is seen in adrenal or emotional shock, when we get a typical picture of sympathetic predominance, but the parasympathetic does not, as a rule, work quite in this way, on account of certain anatomic differences in its build. Here certain functions or organs only, innervated by the parasympathetic part of the autonomic nervous mechanism, may show deviations from the normal, the remainder behaving normally. For instance, should this be the lungs, asthma may come about, if the nasal mucous membranes, hay fever, if the organs in the portal area, hyperchlorhydria or mucous colitis, and so on. Thus the symptoms of a constitution essentially parasympathetic need not always be the same; in some these may refer to one set of organs or functions, in others to another.

Mr. Cutler picked out one type of parasympathetic status, the dull, heavy child, predominantly anabolic, with enlarged lymphoid tissue, water-logged, and deficient of thyroid secretion, but all parasympathetic dominant individuals do not show these characteristics. Mrs. Lindsay and Mr. Steadman criticized Mr. Cutler's hypothesis because they found postnormal occlusion in persons who do not conform to his class, which I suggest he made too narrow, and, on the contrary, because they have found this same deformity in persons of another type, which they make too wide; this does not, however, mean that these are of the opposite type, the sympathetic, but rather that their parasympathetic dominance did not affect the particular organs which Mr. Cutler had stressed. It is

true that Mrs. Lindsay called these children acidotics, but it is so easy to go wrong in attempting to classify children from obvious signs only. For instance, I have recently investigated a young man of about twenty-one years, active, bright, pale, and anemic looking, subject to asthma and hay fever, with beautiful teeth, who gave all the characteristics of parasympatheticotonia, and hydrated colloidal particles. He might easily have been called an acidotic by a person with incomplete knowledge, which he certainly was not; indeed he was highly alkalotic.

Again, constitution, the consequence of inheritance, is not the whole story; this simply sets the threshold from which the strains and stresses of life begin to act; it is these latter which bring about the signs and symptoms of disease, and if the stresses are not present the special characteristics will not appear; if these should be of the opposite kind, and severe enough to overcome constitutional tendencies, then the opposite signs may show themselves. These stresses, for example, may be dietetic, carbohydrates tending to dehydrate the colloidal particles and therefore to shift the patient to the sympathetic side; if he be predominantly parasympathetic to begin with, no ill effects will come about, but if sympathetic in tendency, but a small surplus of carbohydrate will be productive of exaggerated signs, as in caries; if, however, the carbohydrate feeding is very excessive, and the parasympathetic dominance but small in amount, this may be sufficient to pass the child over to the sympathetic, although he be constitutionally parasympathetic.

All the difficulties encountered in appreciating this approach to the etiology of disease revolve around what we mean by the word disease. Is this to be limited to end-points only? Are we to consider, say, chronic interstitial nephritis as a disease, and all the circumstances which slowly lead up to the formation of fibrous tissue within the kidney as health? Surely not; yet medicine, as at present practiced, is not interested in and cannot diagnose disease until it has reached an end-point, with damaged organ or changed function. As dentists, we are equally blameworthy; we diagnose a tooth cavity as caries, but all the circumstances which have led up to the enamel decalcification we perforce disregard, yet the latter in reality constitute the carious process, the former being just an end-point.

I once stated in a paper that we had not the slightest idea as to what was meant by disease, and the sentence was censored out by an indignant sub-editor, who was quite certain that he, or she, knew all about it; but I, most humbly, beg to differ.

Disease, like health, is a dynamic and not a static process; a deviation from the normal in physiologic processes, which slowly and inevitably lead up to organic changes, which themselves are not diseases but the consequences of disease; and these deviations are the result of changes in vegetative balance, which alone constitute disease at its onset.

I have shown you an ultramicroscopic blood picture, the basis on which vegetative stability or instability is built. Of course, the matter is by no means as simple as one of hydration or dehydration of colloidal particles. I have no opportunity at this time to go further into the details and altered pictures in

disease, such as would be presented in different conditions. It is, however, along the lines suggested that all disease commences, whether this be dental caries or pyorrhea, allergy, arthritis, or even susceptibilities to this or that infection.

The physiologic dehydrators and hydrators of the colloidal particles, through which the body attempts to maintain a stable vegetative balance, are the hormones and the vitamins, which thus come into the picture medically and scientifically. It is not enough to diagnose an hormonic deficiency or excess, or a vitamin deficiency at one end of the scale and the fully developed lesion, medical or dental, at the other, and think that the whole matter is solved. There obviously must be intervening links through which the one or the other brings about the end-point.

As a leader-writer in the *Lancet* recently stated: "The difficulties met with in our understanding of diseases of nutrition are, to a large extent, the legacy of a not very fortunate conception of specific deficiency diseases which was put forward in the early days of the study of vitamins. This conception which finds expression in such terms as antirachitic, or anti-infective vitamins, postulated a direct causal relationship between vitamins and certain diseases. The disease was supposed to spring into being without any intervening pathologic changes as soon as the vitamins in the food were withdrawn and any reserves within the body exhausted. At present it is widely believed that rickets, for example, must necessarily appear when the antirachitic vitamin is not present in the food in sufficient quantity. But Sherman and Pappenheim published experiments nearly ten years ago showing that rickets does not occur in the absence of vitamin D if the proportion of calcium and phosphorus in the diet is kept near the optimum point. The real function of the vitamin is to correct the absorption and assimilation of calcium and phosphorus when these are not supplied in suitable proportions. The term antirachitic vitamin is therefore misleading so far as it gives the impression that the absence of this vitamin must necessarily be followed by the disease."

As a matter of fact Hahne and also McDonagh have shown that the vitamins act solely through their effect upon the surface tension of the colloidal particles; vitamin D, for instance, being a hydrator, that is increasing parasympathetic effect, increasing alkalinity, and drawing into the colloidal complex the calcium, whereas vitamin C acts as a dehydrator with the opposite effects. Hormones, similarly, act through the colloidal system, the thyroid and adrenals being the natural dehydrators. If we consider this carefully we shall see how these various substances bring about the changes within the body associated with their excess or diminution, through vegetative activity, stimulating or depressing metabolism, increasing catabolism or anabolism, and regulating the conservation or expenditure of energy.

The action of insulin McDonagh believes to be that of a dehydrator. It is usually believed that this substance acts primarily upon blood sugar, thereby regulating carbohydrate metabolism. From what has been said it will be seen that in the act of hydration the colloidal particles will draw sugar more firmly into the colloidal complex, in which form it will become unrecognizable to ordinary methods of analysis; consequently a hyperglycemia would be made to disappear, or even to be replaced by a hypoglycemia on the administration of in-

sulin, without this substance being in any way specific to blood sugar. When we come to consider that the methods which, experimentally, will prevent insulin shock, usually considered to result from hypoglycemia, are the giving of dehydrators, of which glucose is one, but oxygen subcutaneously, and many other substances, such as adrenalin, are others, we see that the matter of sugar as such does not primarily come into the story. As a matter of fact, I have used this idea in the treatment of excessive caries in nondiabetic young children: if dental caries is due, as I believe, to an acidosis, to a predominance of sympathetic function, to a dehydration of the colloidal particles, then hydration should be the preventive treatment. I have found in the small number of cases in which I have been able to experiment, that daily doses of insulin over a period of two to three weeks bring about the definite clinical entity of arrested decay, without any other change whatsoever in the daily life of the children. This is not the opportunity further to discuss this matter, as there are certain difficulties to be overcome, but I submit that it does definitely prove my hypothesis.

In this way, with a visualization such as is here presented of disease in its onset, we are enabled to see just how a particular constitution, resulting in a peculiar metabolic activity, links up various symptoms and end-points. Cutler finds, as do others, that what he has described as the lymphatic diathesis is frequently associated with a certain type of malocclusion. There are exceptions both ways, as there are bound to be if one attempts to draw conclusions too rigidly without taking into consideration all the factors on which the association rests. For example, I recently had a small boy sent to me for advice as to the prevention of very rapid caries. By constitution he was a parasympathetic dominant, but on investigation one obtained figures of acidosis, sympathetic predominance, and dehydrated colloidal particles. The history, however, solved the seeming paradox. The boy had had frequent attacks of angioneurotic edema, a definite parasympathetic syndrome, he would have gone into Cutler's group of lymphatic, water-logged, thyroid-deficient children. His teeth had been exceptionally good until a year or so ago, when they started to go wrong, the reason, incidentally, why he was referred to me, at about that time he had had a very severe attack of measles, so severe indeed that he almost died of bronchopneumonia, this was followed in a few weeks by whooping cough, to which naturally his parasympathetic constitution would not make him immune, although it would alter the character of his reaction to the infections. The consequence of these illnesses, naturally, would be to swing his metabolic activities over to the sympathetic side, giving him a tendency to caries although his primary characteristics were parasympathetic.

But when we find, as I believe we do find, that generally speaking, the teeth of these children with postnormal occlusion are of exceptionally fine quality and to a very great extent are free from caries, we get yet another association with parasympathetic status. And when we go one stage farther and find what I believe is a recognized after-effect of treatment—pyorrhea supervening in middle life, so frequently attributed to excessive movement of the teeth and damage thereby to the periodontal membrane, but obviously, according to my conception of etiology, due to the constitutional imbalance which was productive of the lymphatic state and of the caries immunity—the whole of our difficulties

of causation fades away. Here, then, we have the *why* these conditions are associated; we have still to consider *how* the parasympathetic state brings about the changes which result in postnormal occlusion.

Here I am afraid it is impossible to be dogmatic; all that I can do is to point out the effect of this condition upon calcium metabolism, upon the ossification and resorption of bone, leaving you with your greater knowledge of the strains and stresses to which the growing maxillary and mandibular bones will be subjected in cases of lymphatic overgrowth, and swollen and congested mucous membranes of the throat, to work out how this abnormality might come about.

We have seen that the chief effect of alterations in vegetative status are dependent upon changes in the activity of the capillary system; that with parasympathetic dominance these are more dilated and permeable, with increased circulation to the tissues supplied. Leriche and Policard point out that bone is not, in reality, the fixed immutable tissue which we are sometimes inclined to believe it to be, but that it is always in a state of flux, taking up, or giving out, lime salts according to the needs of the body at any particular moment; that the bones, in fact, are the great calcium reservoir of the body. They say: "Important relations connect bone resorption with an increase in the blood circulation; wherever this is increased there will tend to come about resorption of bone, and where it is diminished, an ossification. The calcium thus freed becomes available for ossification elsewhere within the neighborhood. The important factor in the stability of bone seems to be circulatory efficiency." When we consider the effects of experimental and surgical alteration of local vegetative balance, such as is brought about by the operation of sympathectomy, the cutting of the nerve fibers containing the sympathetic nerve supply to a particular area, we see that this is upheld. Quoting these same writers again: "In an entirely empirical way we can today consider it as established that periarticular sympathectomy at a distance modifies the region in a definite way. In fact, it is followed, experimentally, by a rapid ossification in the fractured zones (of bones) and, clinically, by a reossification of regions in too active resorption, where there is no utilization on the spot of the freed material. With all the reservations which the insufficiency of our knowledge imposes one can say that periarticular sympathectomy precipitates bone resorption, and thus permits ossification, but that these phenomena may pass beyond bounds. Events take place as if there were, for the preservation of bone, an optimum of circulation which this operation modifies in a direction which is always the same, but in a quantity that we do not know how to proportion."

Now the condition produced by sympathectomy is obviously one of parasympathetic dominance in the area affected, the removal of sympathetic stimuli allowing the antagonist, the parasympathetic, to have complete control; consequently we have in these cases changes in bone deposition and removal which could presumably affect such parts, in growing bones, as the glenoid fossa and rami of the mandible, should these be subjected to certain stresses such as might be produced by diminished airways, which themselves might be the consequence of the same disturbance.

I feel the inadequacy of this paper very strongly; my excuse must be that the subject is too large for a single contribution. I am at present engaged in an attempt to deal more adequately with the matter in the form of a book, where my stage is so much wider. If I have been enabled to interest any of the members of this Society in a new approach to the etiology of malocclusion, they will, at their leisure, be able to follow up the suggestions which I have brought forward.

DISCUSSION

Mr. R. Cutler said that some years ago he had had the temerity to read a paper to the Society dealing with the application of modern pediatrics to the study of orthodontics. That paper had met with a rather cold reception, a number of members of the Society feeling themselves quite unable to lend support to his views. He had not been at all discouraged, however, as he had realized that the fault lay with himself in not making his meaning fully clear at the time. In his opinion, subsequent experience had entirely confirmed the truth of the views he had expressed in his paper, and it was rather pleasant to him to hear those views supported on the present occasion by some one who was not an orthodontist but had arrived at his conclusions on general reasoning. Mr. Broderick had rather taken him to task for having made such a limited survey of an exceptionally deep subject, and he was afraid that that kind of reproof must be given to many junior colleagues who started investigations upon subjects of orthodontics or general dental interest. The reason for that was that practicing dentists had little or no scientific background to enable them to approach the study of complex problems, such as the one under discussion, at all efficiently, and, even if they had, the stress and strain of conducting general or specialized practice under modern conditions entirely sterilized the enthusiasm they might have felt during their earlier years. That was probably one of the troubles that beset the study of orthodontics at the present time. There were, on the one hand, expert clinicians and technicians, who went on perfecting their art more and more and obtaining beautiful results, often obtaining those results, probably, in a way that they could not explain; and, on the other hand, there were the completely academical workers, who probably knew nothing at all about orthodontics and who might know nothing about dentistry even, but who carried out a great deal of research work upon jaw growth and other subjects of tremendous importance to orthodontists. There were very few people who combined a practical knowledge of orthodontics or dentistry with a really scientific background and who could thus act as liaison officers between the two opposing groups. There were technicians like himself, on the one hand and, on the other hand, there were workers in medicine and pathology and embryology who were doing a great deal of excellent work on matters which might be very relevant to the practical side of orthodontics, but there was no one to focus their energies and abilities on lines that would be of help to orthodontists. Whether the members agreed with Mr. Broderick's views or not, they should be extremely grateful to him for presenting new viewpoints on old subjects. Mr. Broderick's paper at least made them take stock of the older explanations of disease and abnormality which had so easily satisfied them in the past. It was not so many years ago that enlarged tonsils, adenoids, mouth-breathing, etc., were regarded as being the direct cause of, or in direct relation to, the Class II condition. At the present time any such connection was spoken of with great diffidence by those who knew most about the subject, and rightly so, but similar ideas had been tamely accepted up to the present; and now, as a result of recent work, whether it was correct or not, orthodontists were at least beginning to question the truth of the old explanations. Dealing more specifically with the subject matter of the paper, he might say that there was one practical point which appealed to him, i.e., the marked resistance to caries of Class II cases. Those who did much hospital work, whatever the disadvantages of that might be, had at least the advantage of seeing the end-points or extremes that disease and metabolic maladjustments might cause. That advantage was denied the practitioner in specialized practice, who dealt with children brought up under the best possible conditions and who very rarely saw the end-points of disease, and who might therefore miss certain basic fundamentals. If those who carried out hospital work reviewed the Class II cases which they had seen at a hospital during the course of a week, he thought they

would agree that those cases had a very high resistance to caries. There was a practical reason for that, namely, that a Class II case in which, for instance, the lower mandibular first permanent molars had been lost as a result of caries was, from the standpoint of the technician, virtually untreatable, and therefore such as would be turned away. If, however, the members reviewed the Class II cases which they had seen in the last week or month or year, they would find there were really very few cases which they felt they could turn away as being technically impossible to treat. Second, Class II cases seemed to develop a degenerative gum condition which might lead on to pyorrhea, for instance, and, again, that condition seemed to develop whether the case was treated or not. Those were two practical points in connection with the subject under discussion, and apparently Mr. Broderick had an adequate explanation for them, which so far had not been given by any other authority. It so happened that the resistance to caries and the tendency to develop a gum condition were clinical signs which were obvious to an ordinary dentist like himself, but he was quite certain that to the skilled biochemist there were many other more subtle manifestations of metabolic and other forms of growth maladjustment which dentists missed and which they would continue to miss until a closer cooperation was brought about between the two entirely opposing forces in orthodontics at the present time. Personally he would be very grateful if Mr. Broderick continued his work on general matters, and, if Mr. Broderick had time to carry out further researches in orthodontic problems, he thought it would be eventually of great benefit to orthodontists.

Mr. Broderick said the whole subject was built upon the question of the inherent diathesis or constitution which an individual possessed from birth or before birth. It would be remembered that the medicine of a hundred years ago was essentially built upon constitution and diathesis, and pathology dealt with various types—the strumous type, the tubercular type, the lymphatic type, the nervous type, and so on. Then there came the work of Pasteur, and diathesis went out of fashion. It seemed as if medicine was on the eve of something which might be called specific etiology, a definite division of disease and a definite division of causation, all disease caused by microorganisms and every disease caused by a different specific microorganism. The hope of that had been disappointing, and it was now known that, over and above the question of a specific microorganism or any microorganism being the cause of disease, there was a great deal to be said for the soil, the individual himself who became infected with the microorganism. The question of soil was a question of diathesis, a question of individual constitution with which the patient was born. It was not quite such an easy matter—taking acidotic fathers and mothers and expecting to find acidotic children. There might be something of the Mendelian law in the matter, but he himself had three children, two of whom were definitely parasympathetic and one definitely sympathetic. If people were to be divided along the lines suggested, that would mean that he was sympathetic and his wife was parasympathetic. The definite constitution which regulated the metabolism of the individual and his reaction to disease throughout the whole of his life was something inherent in him. It was most noticeable, of course, in the extremes, the extreme parasympathetic dominant and the extreme sympathetic dominant. There were many other forms of classification, such as the acidotic or the alkalotic, or, coming to McDonagh's views, the hydrated or the dehydrated individuals, with reference to the state of the protein particles of their blood, which McDonagh believed to be the essential difference in the reaction of every individual to disease. He would suggest that even the earliest type of malocclusion or the earliest stage at which a dentist saw it was an end-point. In that connection he did not agree with what Mr. Cutler had said, that in hospitals the end-points were seen, whereas private practitioners did not see end-points. Personally he contended that all the stages were end-points. Leading up to the end-point was the constitution of the individual from the moment of his birth, and then there entered into the question such things as calcium metabolism, giving a mandible which would react differently to various strains and stresses. He could not enter into a discussion on that subject, because he knew nothing whatever about it. If the members present would bring forward the difficulties which they felt in understanding what he was attempting to talk about, it would help him very much in explaining the matter. Having been dealing with the subject for the last twenty years he found it a little difficult to appreciate the points which some of the members might not understand, as they had become to him quite simple matters.

Mr. Bradlaw asked if Mr. Broderick would state what physiologic evidence there was for the existence of a sympathetic and a parasympathetic system which were physiologically antagonistic. He did not know why they should be regarded as pulling in different directions. Unless the members could understand that fundamental point, he did not think they could grasp Mr. Broderick's learned argument. With reference to the liaison between the research worker and the clinician to which Mr. Cutler had referred, an attempt was being made at the present moment by the British Dental Association to bring about such a liaison, so that the pure research worker, the physiologist and the pure scientist might be put into touch with the needs of the clinician. He felt it might be possible for the Society to do something along the same lines to make known the needs of clinical orthodontists.

Mr. Broderick said that, with regard to the evidence of a nervous system built up of two antagonistic parts, without having time to think the matter out along proper lines, he would make the following suggestion. There were individuals whose pulses ran in the sixties and the low seventies and others whose pulses would always be in the high seventies and the eighties. If the individuals in the latter class were treated with drugs which stimulated the sympathetic, their pulse rates would go up. There were patients to whom an injection of adrenalin, for example, would give a mild shock, and there were patients who could be given very much larger doses of adrenalin without any fear of shock. Obviously those who were affected by adrenalin were the sympathetic dominants, in whom normally the adrenal secretion was marked, and those who were not affected by adrenalin were the parasympathetic dominants, whose adrenal and thyroid glands were relatively inactive. Taking the patients with normally quick pulses, their pulse rates would be reduced by injections of atropin, which paralyzed the vagus. It was from pharmacologic experience that Eppinger and Hess of Vienna built up the clinical differentiation between the two classes of patients whom they called sympatheticotonics and vagotonics, but later physiologic knowledge had gone much farther than that, and it was now realized that the vegetative status of the individual was not regulated entirely by the sympathetic or the vagus nerve supply. It was a question of the reaction of the tissues, as to whether they tended to be acid or alkaline; a question of the predominance of various ions, particularly those of calcium, on the one hand, which stimulated the sympathetic, and potassium, on the other hand, which stimulated the parasympathetic; a question of hormonic influences, and, according to McDonagh, a question of the size of the protein particles. In people whose metabolism was dominated by the vagus, parasympathetic, side of their vegetative system the tendency was for the protein particles to be large, whereas they were small in the sympathetic dominants. Any one who was interested in the subject and watched people in trains and trams, and so forth, could build up a very great deal from it by classifying people according to whether they were dominated by the one or by the other side of the vegetative system. One could then come to the question of temperament, of psychology, of reaction to infections, or reaction to emotions, and so forth. He thought there could be no doubt at all clinically that in a greater or a lesser degree the vast majority of the inhabitants of the world could be put into one or the other group.

Mr. W. A. Bulleid said he realized from what Mr. Broderick had said that the protein ions which Mr. Broderick had shown under the microscope varied with the dominance of the sympathetic or the parasympathetic system, but he was not clear whether Mr. Broderick attributed the dominance to the protein particles in the blood or vice versa. Why were the protein particles large in the parasympathetic dominant and small in the sympathetic dominant? Was it because of the dominance of the particular nervous system, or was the nervous system the cause of the size of the particles?

Mr. Broderick said he wanted to make it quite clear that the modern physiologic teaching was that the constitution or diathesis was due to what was now known as the vegetative system in contradistinction to the vegetative nervous system, and the build of the vegetative system was due to a number of things interconnecting the one with the other—the size of the protein particle, the calcium-potassium ratio ,and the hydrogen-hydroxyl ratio. If a patient was given large doses of alkali, his protein particles would be hydrated; if the vagus was stimulated, the protein particles would be hydrated, and at the same time the potassium would be increased in proportion to the calcium in the body cell. It was a little difficult—

in fact, quite impossible—to say which was the essential feature, because they all reacted one with the other. If one enlarged the protein particle, as could be done by certain synthetic chemotherapeutic drugs, one altered the reactions of acids and alkalies in the tissues, one altered the relation of calcium to potassium, and one altered the stimulatory threshold of the sympathetic and parasympathetic nerves. With regard to the question of sympathetic and parasympathetic dominants, there were very definite differences in the pathologic conditions from which they suffered. All the conditions which were known as the allergic conditions—asthma, hay fever, urticaria, mucous colitis, eczema, angioneurotic edema—occurred only in the parasympathetic dominant, the reason being, according to McDonagh, that any of the protein poisons which brought about those conditions simply acted by enlarging the protein particles to such an extent that they became precipitated in the capillary lymphatics of the tissues. If they happened to be the mucous membranes of the nose, hay fever resulted; if they happened to be the capillaries of the skin, urticaria resulted, and so forth. A sympathetic dominant was never an allergic. A person who got hay fever or asthma or any of the allergic conditions was a parasympathetic dominant, and if the members watched their own patients they would find—not in every case because other circumstances came in and upset it—that there existed a kind of immunity to caries in the allergic persons and that they got pyorrhea in the early years, other things being equal.

Mrs. Michaelis said she would like to hear further opinions, from the purely orthodontic viewpoint, on the question of the absence of caries in Class II cases. She happened to have a pair of models of a typical Class II case, which was badly mutilated by the loss of the mandibular first permanent molars through caries and the incisors were also carious. She did not know whether she was particularly unlucky, but in her hospital clinic she had not found her treatment of Class II cases made any more easy by an absence of caries, and she would very much like to hear the experience of other hospital clinicians. It seemed to her that the question of stomatitis and gingivitis in such cases could be a purely mechanical one. The mouth was kept open and therefore the gingivitis occurred, its cause being nothing more complicated than that.

Mr. R. O. Barber said he thought Mr. Broderick had neglected one of the most important people in connection with malocclusion, namely, the mother. On the analogy of caries being only the end-point of metabolic upset, malocclusion was, to his mind, an end-point due to a variety of causes. First, there were maternal hormones which were circulated in the mother's blood while the fetus was developing. It was a well-known fact that the jaws in the fetus did not develop at the same rate. The maxilla suddenly shot ahead, and then the mandible, and he thought the alternating growth could quite possibly be influenced by some parasympathetic disturbance in the mother, which, if continued, would probably cause the development of malocclusion. With regard to the testing of the blood of the child, he would suggest that the mother's blood should be tested first, and then it would be discovered whether the child was likely to be a marked Class II or a marked Class III case. Again, the maternal hormones might be an indirect cause of irregularities in the jaws, chiefly in their occlusion and not in the arrangement of the teeth. For instance, it was the practice nowadays, he believed, for mothers to arrange that their children should be fed by nurses. That again must have some effect upon the child, because the mother would naturally think of this before the child was born, with the result that the hormones would be circulating in her blood, and when the child was born the natural methods of feeding were negligible. The members had probably seen a number of cases at various times which showed the deleterious effect of bottle feeding. He felt that that was to a large extent parasympathetic. In the latter part of the paper Mr. Broderick spoke of the removal and deposition of bone material at the expense of the jaws. Why should the jaws be affected more than the rest of the body? Working on that basis, if the jaws were affected, then when dealing with a Class II case one would expect to find that the tibia, for instance, or the bones of the hand would be deformed in some way, but personally he had not experienced that. He believed that two German research workers had mentioned what they called the "congenital component," i.e., that a bone, no matter what it was, would always assume its normal shape and size unless there was some

very grave etiologic upset. He did not think that the majority of children whom orthodontists saw had been affected in the way described, and he did not think the matter was explained by parasympathetic dominance.

Mr. Gordon Taylor said he wished to present another picture, i.e., that of the edge-to-edge bite. He would not say that no caries was found in the case of an edge-to-edge bite, but there was found a resistance to caries; the teeth seemed particularly hard and well calcified. Then, later on, when the patients reached the early forties, pyorrhea was found. He thought the edgeways cases were the cases of traumatic occlusion which one heard so much about, but whether it was traumatic occlusion or whether there was something in the patient himself which was responsible for the gum trouble, he left to Mr. Broderick to say. Personally he had noticed that a large number of patients with gastric ulcer had edge-to-edge bites. He presented that picture of the edge-to-edge bite—resistance to caries, early pyorrhea, and gastric ulcer—and he would like Mr. Broderick to evaluate the picture.

Mr. Broderick said that, with reference to the bones of the jaw being affected and not the bones of the rest of the body, that was a question which, as he had said in his paper, he knew nothing about, a question of strains and stresses due possibly to other symptoms of parasympathetic dominants, such as an increase in lymphatic tissue, and so on, giving differences in size of air passages, which would tend to alter the shape of growing bones in the jaw more than in other parts of the body. Definitely associated, as Mr. Cutler had said in his paper, with parasympathetic dominance was an increase in lymphatic tissue, which would, he took it, throw a greater strain upon such a condition as the size of the mandible, the depth of the glenoid fossa, and so on. He could not go further than that. With regard to the association of gastric ulcer with edge-to-edge bite, gastric ulcer was essentially a disease of the parasympathetic dominant, because the secretory nerve to the stomach was the vagus, and increased vagus action would tend to give a hyperchlorhydria. One could not dogmatize too much in that connection, because the hyperchlorhydria might also be due to spasm of the pylorus preventing a regurgitation of juice from the duodenum, and the innervation of the pylorus was sympathetic. With reference to the question of gingivitis, there had been a time when he had definitely differentiated certain types of marginal gingivitis from the marginal gingivitis which was the first sign of a commencing pyorrhea. He would not be quite so dogmatic on that point today as he had been two or three years ago, because it was suggested that all inflammatory phenomena were brought about by a definite ratio of hydration to dehydration, and that infection took place only as that ratio was reached. The matter might be looked upon somewhat as a ladder, with pure dehydration as the bottom rung and pure hydration as the top rung. Though pure hydration and pure dehydration were very rare conditions, the pathologic changes in the protein particles had almost always a proportion of dehydration to hydration. Thus the bottom rung of the ladder would be dehydration, and then would come dehydrato-hydration, hydrato-dehydration and hydration. The inflammatory part of that ladder would be a certain ratio of dehydration to hydration. If one put against that ladder dental lesions, there would be caries with the lower rungs, pure dehydration, and dehydrato-hydration with dehydration much predominating. A little farther up one would get caries with gingivitis, then gingivitis, and then gingivitis and pyorrhea, and then, as one reached the top, one would get Gottlieb's type of pyorrhea, in which the gingivitis element was very small. Consequently one would expect to get more and more gingivitis as one got the parasympathetic innervation coming more into the picture, gingivitis becoming more and more pronounced until one reached the extreme parasympathetic dominants, when gingivitis would cease to exist.

Department of Oral Surgery

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RADIUM APPLICATION IN ORAL SURGERY

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IN cancer about the face, mouth, and jaws, proper radiation methods sometimes may be selected with the expectation of being of value in three types of situations. In two other situations often radiation methods are advised. But in these fourth and fifth situations the hope of benefit has fostered a type of therapy which possibly borders upon the empirical and for which as yet exact evidence is lacking which allows one to state its value definitely.

In the first situation, the local lesion in varying percentages of instances according to factors of sensitivity, extent, and location may be made to disappear permanently or for the time being. This statement, however, does not mean that radiation methods are necessarily the methods of choice, as methods of excision may be more efficient and vice versa.

In the second situation, when metastatic glands have advanced to such a state that complete removal is not a feasible procedure, in a varying percentage of instances, marked palliation may be given by the use of proper methods of radiation. Then, because no other choice as to method remains, the indication is obvious.

In the third situation, undoubtedly in certain tumors it is possible to forecast with considerable accuracy by clinical acumen and microscopic study that the newgrowth is one of a radiosensitive type. For such tumors other methods of treatment are not to be considered.

In the fourth situation, radiation methods have been advocated for the tributary lymphatic glands as a prophylactic measure. The theory of the amount of irradiation necessary for lethality argues against the conception unless the original tumor was one of a radiosensitive type. Preoperative irradiation of the tributary lymphatic areas of the type theoretically capable of being lethal for any malignant cells that may be present (Coutard for instance) almost fixes the tissue of the neck into a fibrous mass so that a bloc dissection may be

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This is the sixth article of a series upon the subject of malignancy in and about the oral cavity. All phases of the subject are to be included.

extremely difficult or practically impossible. Besides this, a thorough "Coutarding" is a relatively severe ordeal in itself, so the patient may be in poor condition for a neck dissection; or, when he appears to be in condition for the operation, it may be at a much later date, at which time it may be too late for the decision to be important. Either he will have evident metastasis or he will be well with no evidence of the disease for a sufficient number of months after the local lesion has healed to make it questionable whether the benefits to be derived are worth while under the circumstances.

In the fifth situation, radiation methods may be used postoperatively on the tributary lymphatic areas and as additional safeguard against recurrence in these areas. The same argument as to lethality is applicable to postoperative irradiation as is applicable to preoperative radiation. But if it is valueless, it at least does not handicap any further therapy. Many men are aware of the truth of the preceding statement about pre- and postoperative radiation treatment to the tributary areas, and still they give one or the other. Rather often more or less routinely postoperative radiation is given.

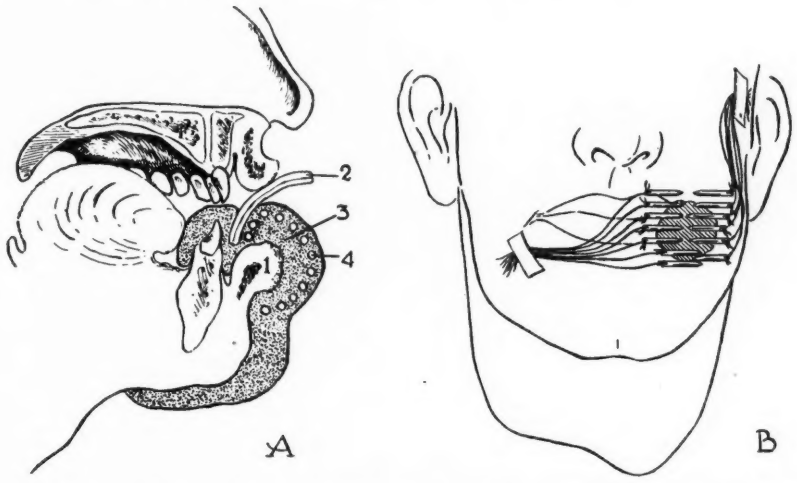

Fig. 1.—*A*, Sagittal section of the method of applying radium about the lower lip for epithelioma: (1) the lower lip; (2) two thicknesses of 1 mm. of lead; (3) modeling composition form; (4) tubes or needles of radium imbedded in modeling composition. The needles may be somewhat closer to the lip than shown in the diagram if desired. This would depend somewhat on the filtration of the radium used.

For calculating the dosage, see the article in the July issue of this Journal.

B, Diagram showing needles inserted into an epithelioma of the lower lip and the left corner of the mouth in interstitial fashion. For calculation of the dosage, see the article in the July issue of this Journal.

Previously, the "Principles Pertinent to the Radiation Therapy or Oral Surgery" were discussed. In this article we are concerned only with the actual manner or the effective way of applying radium. Attention should be drawn to the method of combining x-rays with the gamma rays of radium as was discussed in the article in the July issue of this Journal. The so-called "surgery of access" necessarily has to be discussed along with the effective way of applying radium.

Therapy of the Local Lesion.—The local lesion of cancer apparently reacts better to radiation when it is comparatively noninflamed. Therefore, before applying radium, it is undoubtedly better whenever feasible to have infections

of and about the teeth and about the local lesion cleaned up as nearly as possible. Sometimes it is better to remove metallic bridges that are near the lesion. When teeth have been removed to improve the condition of the mouth, one should wait about three weeks for the cavity in the gum to form a granulation tissue wall.

Fig. 2.

Fig. 3.

Fig. 2.—*A*, Photograph of patient with epithelioma of the lip before treatment; *B*, after treatment by application of radium as in Fig. 1*A*.

Fig. 3.—*A*, Photograph of patient with epithelioma of the lip before treatment; *B*, after treatment with radium.

The Lip.—The local lesion in epithelioma of the lip, when the extent of the lesion is confined to the upper third of the lip, in the majority of cases may be treated very effectively by radium. An interstitial or an external method of application may be used. Unless the lesion has involved a rather large part of the soft tissues of the lower lip or has extended outward and involved the cor-

ner of the mouth, it will be found that the lip lends itself particularly well to external application of radium. When radium is applied externally, the whole lower lip may be enclosed in a form (Fig. 1*A*) and sandwiched between or nearly surrounded by radium so that a cross-firing is obtained. If the lesion involves a goodly part of the soft tissues of the lower lip or extends outward to the corner of the mouth and radium is decided upon as the therapy of choice, radium implanted interstitially is likely to be an effective way of making the application (Fig. 1*B*). For the general run of cancer of the lip, surface radiation is regarded in most clinics as being superior to interstitial radiation.

A somewhat standard method of application of surface irradiation is to pull the lip outward and surround it with a dental wax form in which radium needles or tubes or radon seeds are imbedded over the part of the wax which will sur-

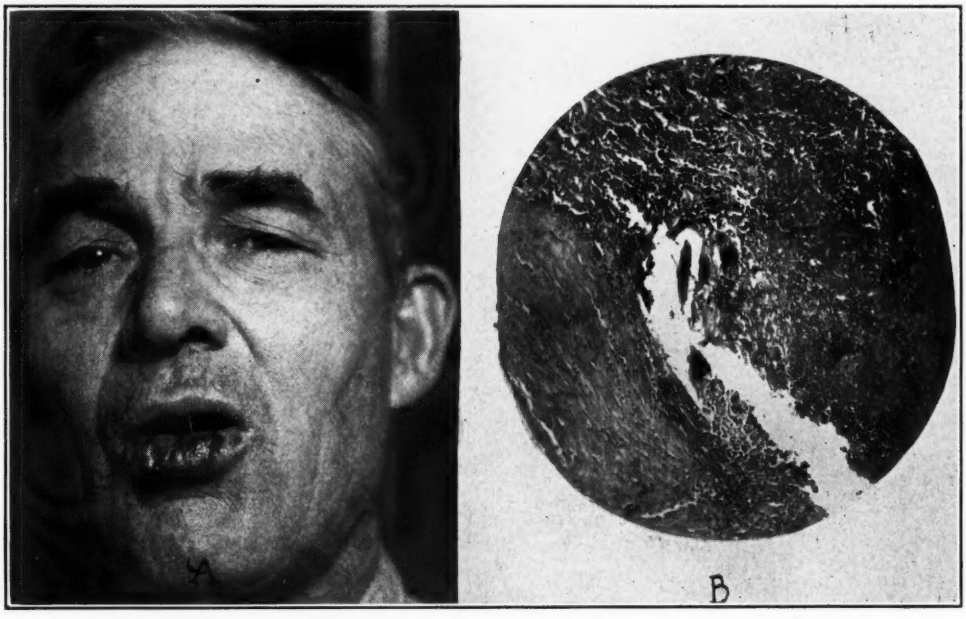

Fig. 4.—*A*, Photograph of patient showing a marked epithelialitis of the lip three weeks after application of radium as in Fig. 1*A*.

B, Photomicrograph of lip carcinoma insufficiently treated by radium. Note the squamous epithelial cells and giant cells.

round the lesion. The form is made to fit over the lower teeth or the alveolar ridge and also to fit down over and beneath the chin. The extension about and beneath the chin allows the form to be held securely in place by a bandage. An effort is made to get the lesion on the lip as far away from the alveolar ridge and the upper lip as possible. To guard the upper lip, the alveolar ridge, and the tongue, two or three layers of lead 1 mm. in thickness are molded on the upper inner surface of the form. In the July issue of the Journal appeared the article in which the calculation of a lethal dosage is discussed when the "sandwich method" of applying radium is used. At Memorial Hospital 80 m.c. hours per sq. cm. of affected surface are given. In many instances when platinum-covered needles of moderate filtration are used, 100 mg. hours are given per sq. cm. of affected tissue. In either case sufficient radon or radium element

is used to give the treatment in from two to four hours. (Figs. 2, 3, and 4.)

When interstitial radiation is used, the needles are inserted under local infiltration anesthesia around and under the lesion in the normal tissues just outside the lesion as much as possible but also through the lesion when it is large and proper distribution of foci makes penetration of the lesion advisable; 0.5 mm. of platinum is an appropriate screening for needles and 0.3 mm. of gold for the radon seeds. Usually the needles should be held in position by a tied stitch through the eye. When interstitial radium is used, calculation of dosage is made according to the method and table outlined in the previous article.

After adequate treatment the height of the radium reaction develops in about three weeks, at which time the lip is red and swollen. In from six to eight weeks the ulcerated lesion should have healed, and most of the redness and swelling should have disappeared. By about the tenth week the tissue should be fairly normal. After ten to twelve weeks, if any induration remains or healing is not complete, the lesion should be excised, as it is probable that carcinoma cells remain which eventually will become active.

The Cheek.—The sandwich principle is applicable to the radiation treatment of epithelioma of the cheek. Without the cheek, surface radiation by either radium or x-rays may be used with an increase of effectiveness. Within the cheek, both surface application and interstitial applications are effective. Without the cheek Ward and Smith have advised that the external plaque contains 2.5 mg. per sq. cm. with a filtration of 1 mm. of lead or the equivalent. This is applied at 1 cm. distance for fifteen hours on three successive days. Usually they consider a suitable plaque as being one 6 cm. in length with a total of 70 mg. distribution over its surface in such a manner as to get a homogenous irradiation. X-ray externally may be used in a similar manner after making the proper calculation according to the amount of internal irradiation.

Needles or seeds may be used interstitially to irradiate the growth. The principle is the same as that for interstitial irradiation elsewhere. All effort should be made to protect the tongue and alveolar ridge by a lead shield. The needles are sewed in. They may be left in place for seven to ten days if they are covered with 0.5 mm. of platinum, if after careful dosage calculation such seems advisable.

Surface application of radium or radon to cancer of the cheek requires some ingenuity of the type which is especially an attribute of the dentist. The greatest difficulty encountered is to make a form which fits the cheek, buccal alveolar sulci, and at the same time within which the radium or radon can be evenly distributed over the proper area. A technic of building an applicator of this type is somewhat as follows: A plaster mold or modeling composition form (Fig. 5*A* and *B*) is made of the vestibule and the upper and lower alveolar ridges and teeth. A negative form of plaster is made from this positive form. The negative form is cut to allow the two halves to separate from the positive mold. Within the negative cast after it dries molten lead is poured. On the cheek side of the surface of the lead form with a knife or drill grooves are cut so that needles or seeds of the proper filtration may be distributed uniformly

over and about the lesion to be treated. The lead form gives adequate filtration so that the tongue and alveolar ridge will not react from the effects of the radium. The needles or the forms are covered with shellac or bakelite. If one desires, with a metal saw he may cut off an outer layer of lead and sandwich the radium between two layers of lead at the proper points. The two layers of lead will be held together after being dipped in shellac. In this manner one may gain some distance and the lead acts as additional filter. The shellac also tends to absorb beta rays. Calculations are made as described in the preceding article of this series.

The reaction following adequate treatment of the cheek should be quite severe and moderately painful. In from two and a half to three months the

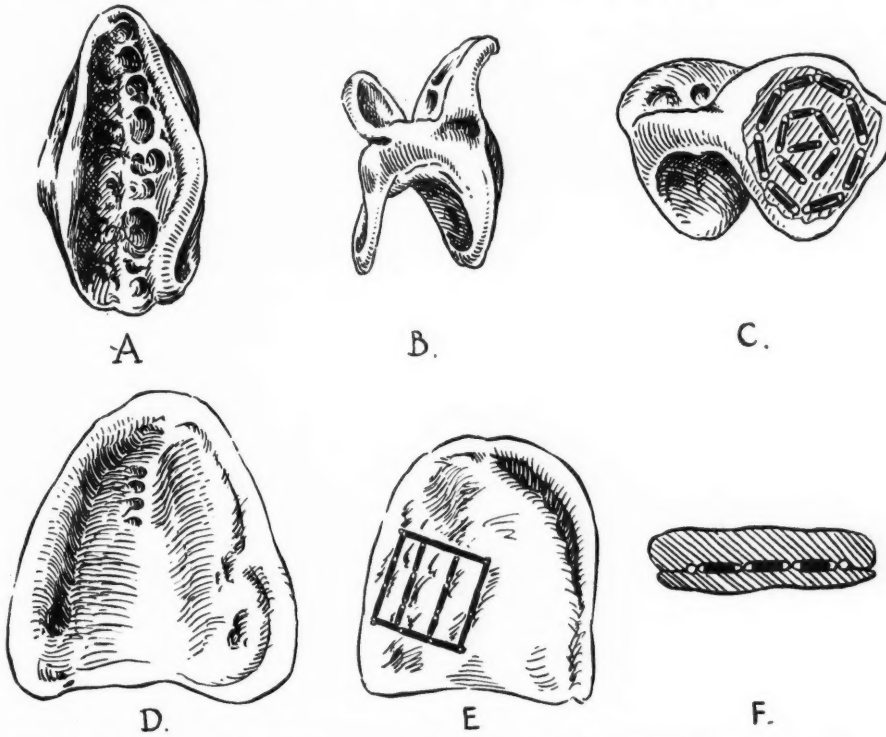

Fig. 5.—Diagram of lead form made to fit over the teeth, to conform to the vestibule, and to lie against the cheek:

A, View of impression of maxillary teeth.

B, Posterior view of the lead form.

C, Lateral view, lateral side to cheek mucosa. Radium foci properly distributed. Foci are held in place by shellac. A small steel saw for cutting iron is used to cross-cut a layer of lead from this side if one desires more filtration between the radium and the mucosa of the cheek.

D, Diagram of positive of a cast of the palate.

E, Diagram of thin lead plate which has been formed by tapping the lead plate with a hammer over the cast. The radium foci have been laid in their proper place in the proper distribution form. Shellac is used to hold the foci in place.

F, Diagram of cross-section of the lead layers with radium foci between the plates. The upper thicker layer (two 1 mm. layers) guards the tongue.

growth should have completely healed and disappeared when the treatment was a satisfactory one. A residual ulceration or induration after this period is an indication for excision.

The Palate.—In the hard palate especially it is obviously difficult to retain needles in position for a week or longer. Excision by diathermy with coagula-

tion of the underlying bone not uncommonly is more likely to effect a cure than is the application of radium alone. Interstitial irradiation is not only difficult here but bone necrosis with perforation of the palate may result. When interstitial irradiation is to be used, radon seeds have considerable advantage.

On the whole, when the decision is made that excision is not applicable, growths of the hard palate are best treated by the external application of radium. After building a mold in the manner somewhat similar to that described for radium treatment of epithelioma of the cheek, the radium needles or seeds may be sandwiched between the two lead plates (Fig. 5*D, E, F*). It is considerably easier to make a lead mold which fits the hard palate than one to fit the check. A plaster impression of the palate is taken. A positive is made. A layer of 1 mm. sheet lead is beaten over the positive cast. A second layer is then beaten over the first. The two layers of lead are dipped in shellac or bakelite, and the needles or seeds are held sandwiched between the two layers of lead. (Fig. 5*D, E, F.*) The needles or seeds may be held in their correct position with ease if they are placed on adhesive tape. The beta rays from the adhesive are blocked by the lead filter. Some additional filter should be placed on the tongue side.

Interstitial radiation can be used to considerable advantage in the soft palate. Sufficient small needles or seeds are placed just outside the lesion in normal tissue. Care is taken not to push them into the nasopharynx. When both the hard and the soft palate are involved, a molded intrabuccal applicator may be the most efficient method of application or the soft palate may be treated separately by the interstitial method.

The Tongue.—In cancer of the tongue when the newgrowth is rather advanced or located posteriorly, a general anesthetic facilitates a proper examination of the full extent of the growth. The interstitial method of application in most clinics is considered to be preferable to any type of surface application. The proper number of needles or radon seeds are introduced around the growth —below and from the sides so as to produce a homogenous type of radiation. Multiple foci of low content aid one in obtaining uniform distribution of quantity. When the growth is of some size, foci should be placed within the body of the tumor. If needles are used, they are completely buried and kept in place by suturing each separately with a suture additional to the heavy string or fine wire placed through the needle eye to facilitate removal or to prevent loss. In the tongue, needles are prone to become loosened during treatment so the fixation must be as secure as possible.

To gain adequate placement of the foci when the infiltration is well posterior, or posterior and lateral, the foci of irradiation, either needles or radon, may be inserted from below. Good radium therapy depends upon accurate placement. Whenever, because of the location, placement is likely to be inaccurate if made through natural anatomical channels, often by the use of some type of "surgery of access" exposure is gained which allows accurate placement.

In the posterior tongue region, radon (Fig. 6*a*) may be inserted by passing a needle through the skin just above the hyoid bone while at the same time,

with a finger in the mouth, one feels where the needle will deposit the encased seed. About 2 m. c. of radon is placed in each seed, and they are placed about 1.5 cm. apart. The filtration is ordinarily 0.3 mm. of gold or its equivalent. (At the Kelly Clinic a larger removable seed is used.) Similarly (Fig. 6*b, c, d*), by making a midline incision (crosswise in the skin and lengthwise in the tongue substance) one may insert needles from the outside containing radium and very accurately determine the point to which they are inserted by finger palpation within the mouth. When needles are used, the time of exposure should be from six to eight days.

Ledoux has advised a periosteal resection of the angle of the mandible with a part of the ascending ramus to aid in attaining accurate needle insertion into the lateral tonsillar and pillar region and the posterior tongue. He recommends a filtration of 0.5 mm. of platinum when radon seeds are used.

Some men advocate that one can accurately insert radon seeds through a direct vision laryngoscope into lesions in this area (lower posterior tongue,

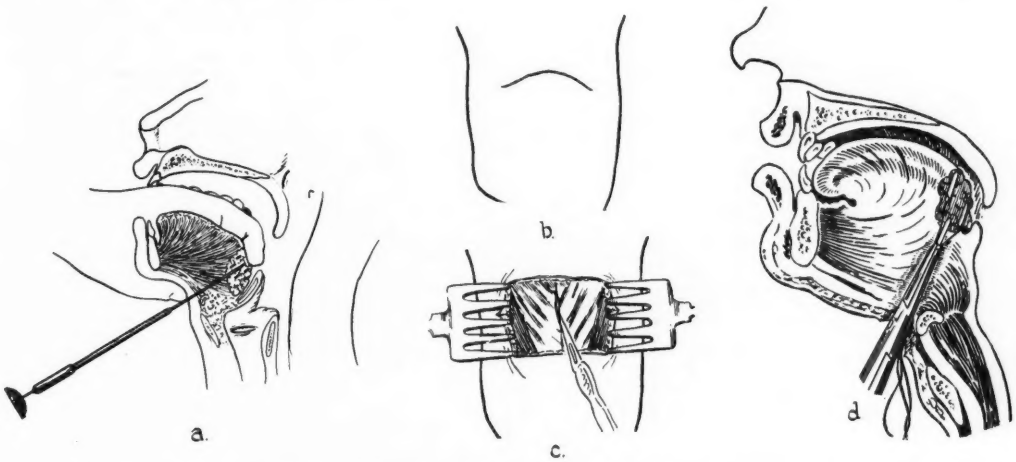

Fig. 6.—(*a*) Diagram of inserting radium seeds in carcinoma at the base of the tongue. Surgery of access to the posterior tongue.
(*b*) Crosswise incision above the hyoid bone.
(*c*) Sagittal section in the midline of the tongue—raphe.
(*d*) Diagram of insertion of radium needles into the area of malignant infiltration. The needles have a string attached to them and are placed in the area with the aid of a special holder which firmly holds the needle and guides it. A finger is inserted over the back of the tongue as in *a*, so that one inserts the needles by a sense of touch. After the needles are inserted, a small pack is placed in the wound, and after the needles have been in place for an adequate period of time—possibly a week—they are removed. After the pack is removed the needles are pulled out.

lower posterior faucial pillar extending toward the pyriform fossa), but in our experience accurate placement is likely not to be made. About the anterior and upper part of the posterior faucial pillar and the lateral, oro, and pharyngeal wall, seeds of radon are particularly advantageous.

Usually external radiation in the more extensive growths should supplement the interstitial irradiation as has been previously described. From two to two and a half skin erythema doses of radiant energy may in this manner be added to the dosage.

Ordinarily after radium is applied to the tongue, the patient is advised to stay quiet, or if some surgery of access has been necessary, he is kept in bed for

several days. During treatment and for a time after, the patient is discouraged from talking, as the reaction will be fairly severe. The mouth is irrigated every four hours. Nothing but fluids are given while needles are in situ.

The week following the radium treatment, the tongue becomes coated with a yellowish diphtheroid membrane, swells and appears red. After about three weeks the induration begins to diminish and after five to six weeks it should have entirely disappeared if a satisfactory reaction is obtained.

When the dose is large, radium necrosis may occur. Syphilitic fibrotic tongues are especially liable to necrose. The necrotic area becomes painful. The excavation becomes covered with a dirty slough. The edges appear red and swollen. Here the difficult point is to be able to distinguish between a necrotic excavation due to radium and a malignant ulcer which has failed to be influenced favorably by the radium. In either case, it is probably best to excise the whole area with the diathermic knife. Excision gives one material for examination and saves considerable pain if it is a radium burn. In most instances a growth which does not disappear within two and one-half months should be excised by surgical means. Often the endothermic knife allows one to excise the area in the easiest and most efficient manner.

The Jaw.—Epithelioma of the jaw itself is due to secondary invasion. In most instances when the malignancy starts on the epithelium which covers the alveolar ridge, the bone is involved when the patient is seen first. In metastatic carcinoma to the region of the submaxillary gland, not uncommonly the induration is partially fixed to the periosteum of the jaw when the patient first appears for treatment. Rather commonly the bone is involved by epithelioma arising in the cheek or in the floor of the mouth. In advanced carcinoma of the lip, bone is likely to be invaded.

Although the density of the bone probably causes secondary rays to increase the local effect, carcinoma of the jaw bone almost universally fails to respond to radiation because of the nature of the tumor bed. As the periosteum of bone is sensitive, intense radiation of bone quite often results in producing a pain which may be quite unbearable. Besides, sufficient irradiation to be lethal may result in complete necrosis.

In inoperable cases of epithelioma involving the jaw bones, external radiation is possibly of palliative value, but in operable cases surgical methods which destroy a part of the bone are usually the only methods which offer a fair chance of a cure.

The Antrum.—For carcinoma beginning in the antrum, surgical excision of the upper jaw offers little or nothing. It is rare to see a patient live much over six months after complete excision alone. The anatomic situation of the antrum prevents adequate radiation from the outside or by intrabuccal radiation from the inside. A combination of interstitial and external radiation plus operative approach for insertion and drainage offers a comparatively good method of treatment. This is true although in a sense neoplasms of the antrum are comparatively radioresistant. Two factors usually present have considerable to do

with this state of affairs: first, the antrum usually is secondarily infected; and, second, the surrounding bone is involved relatively early. Moreover, besides these adverse factors, an overdose of radium in the antrum or even a lethal dose generally causes some radium necrosis of the surrounding bone.

When the tumor has not as yet shown any evidence of perforation into the mouth, a Caldwell-Luc operation may be performed. In carrying out treatment by this approach, the sequence of events would be somewhat as follows: the anterior antral wall is entered, and at the same time a large opening is made

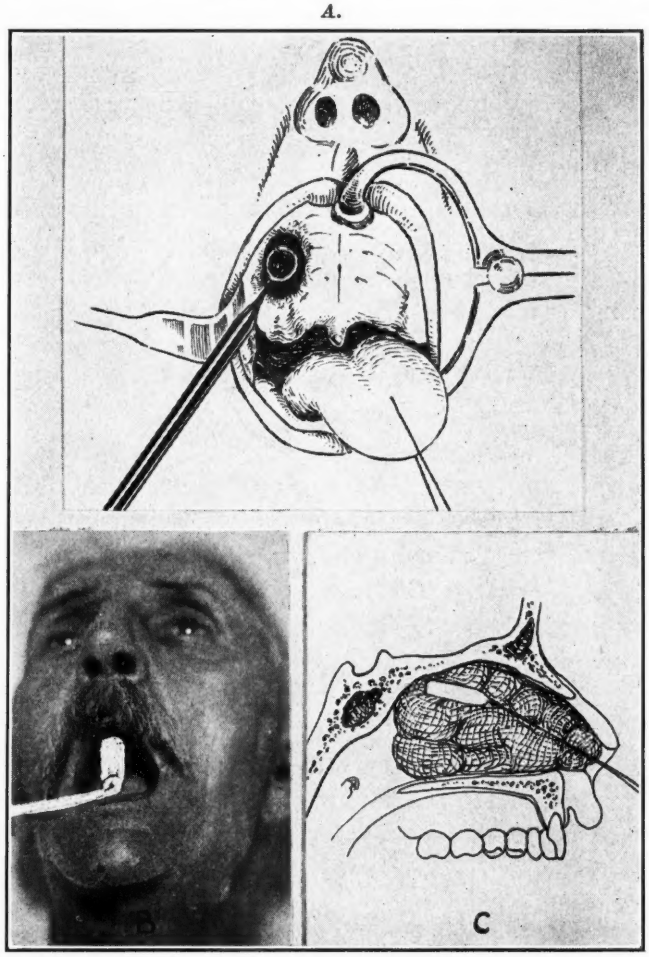

Fig. 7.—*A*, Diagram showing the use of the diathermic loop to gain access to the antrum to cull out thoroughly the malignant tissue in the cavity of the antrum. After this has been done, a coagulating current is turned on, and any involved bone is thoroughly destroyed by a process of coagulation.

B, Diagrammatic photograph of the use of a hot iron to enter and hollow out the antrum. Radium is then placed in the resulting cavity. This method was used some years back but the endothermic loop as shown in *A* is more efficient.

C, Diagram of tube of radium inserted into the nose in the ethmoidal region. Gauze has been packed around the tube. The tube has been covered with rubber or aluminum foil. In antral cancer often there is an extension toward the ethmoid cells.

into the inferior meatus of the nose. The antrum is examined. All tumor tissue that one can find is removed by the aid of the loop diathermic knife. Radium is inserted within the central cavity as indicated through the hole in the anterior central wall.

Antral carcinoma often perforates into the mouth. When such is the case, the following method of treatment is considered to be sound. The diathermic knife (Fig. 7*A*) is used to enlarge the hole of perforation whether it be in the buccal alveolar sulcus, in the alveolus, or in the palate. All soft carcinomatous tissue is scooped out with an endothermic loop. Some years ago a small soldering iron (Fig. 7*B*) was often used for this purpose, but endothermic methods as developed at the present time are more graceful. The hemorrhage is less and danger of burning the inside of the mouth or tongue is less. With the endothermic loop it is much easier to see exactly what one is doing and to distinguish the line of infiltration of the tumor. When all visible malignant tissue has been completely removed, and any involved bone has been thoroughly coagulated so that it will sequestrate, radium needles or radon or radium in capsules surrounded with a gauze packing is inserted into the cavity. In a good many cases it is wise to insert a tube of radium—10 mg. or so—through the nose into the ethmoidal region (Fig. 7*C*). The dosage is computed according to the methods described in the previous article so that from seven to eight skin erythema doses are given from the inside, provided that two or three erythemas have been or will be given from the outside. Usually, before internal application of radium, external radiation is given in a dosage maximum for the skin by cross-fire methods. Harmer first stressed the value of preliminary external radiation before biopsy or internal treatment. An adequate approach is given and good drainage is instituted by this method. Although the cautery is used for destruction of a good part of the tumor, radium and x-ray are depended upon to kill the outlying cells. After the radium is removed, the cavity is irrigated, observed, and treated until all sequestra have separated.

Nose and Nasopharynx.—The normal mucosa of the nose and the nasopharynx is very sensitive to radiation. A large dose of radium produces an atrophic rhinitis which, although the tumor is cured, is disagreeable. Besides this disadvantage, the majority of the tumors in this region are somewhat resistant. Nevertheless, because of the anatomy of the region, often one is forced to depend upon radiation therapy if a chance for a cure is given.

As in epithelioma of the antrum, it is probably wise to give a part of the radiation by external methods, and preferably the external radiation should precede the application of the local radiation.

When the decision is made to treat a neoplasm of the nasopharynx by means of radium, either needles or cells made up into a small bundle or a small radium tube surrounded by the proper filtration may be inserted up above the soft palate into the nasopharynx. A catheter is passed into the nose (Fig. 8*C, D, E*) back into the nasopharynx and down until its tip is seen in the oropharynx. With forceps the tip of the catheter is caught and brought forward through the mouth. Two tapes are attached to the radium which has been made up in a small package of the proper size and shape. The end of one tape is tied to the tip of the catheter. The catheter is then pulled out through the nose bringing the tape with it. By this means the package of radium is pulled into the nasopharynx above the palate.

In large growths (Fig. 8*A, B*) the palate may be split and the needles or radon seeds placed under direct vision. The soft palate unites well if prop-

erly repaired after this procedure. The method gives the utmost accuracy of placement. A pack may be laid in above the soft palate to shield it somewhat. Later it is removed through the nostril anteriorly.

Tonsil, Faucial Pillar, and Oropharynx.—When it is decided that radiation methods are indicated, in tissues of the tonsillar, faucial pillars, or oropharynx region, a good part of the requisite radiation may be delivered by external radiation. Coutard, as is well known, treats these lesions by external radiation (x-rays) entirely. At Stockholm, Berven[1] uses mass irradiation (3 gm. unit) externally, and, if any residual growth remains, it is treated by interstitial irradiation or diathermy or both. Most clinics supplement the external radiation with internal radiation.

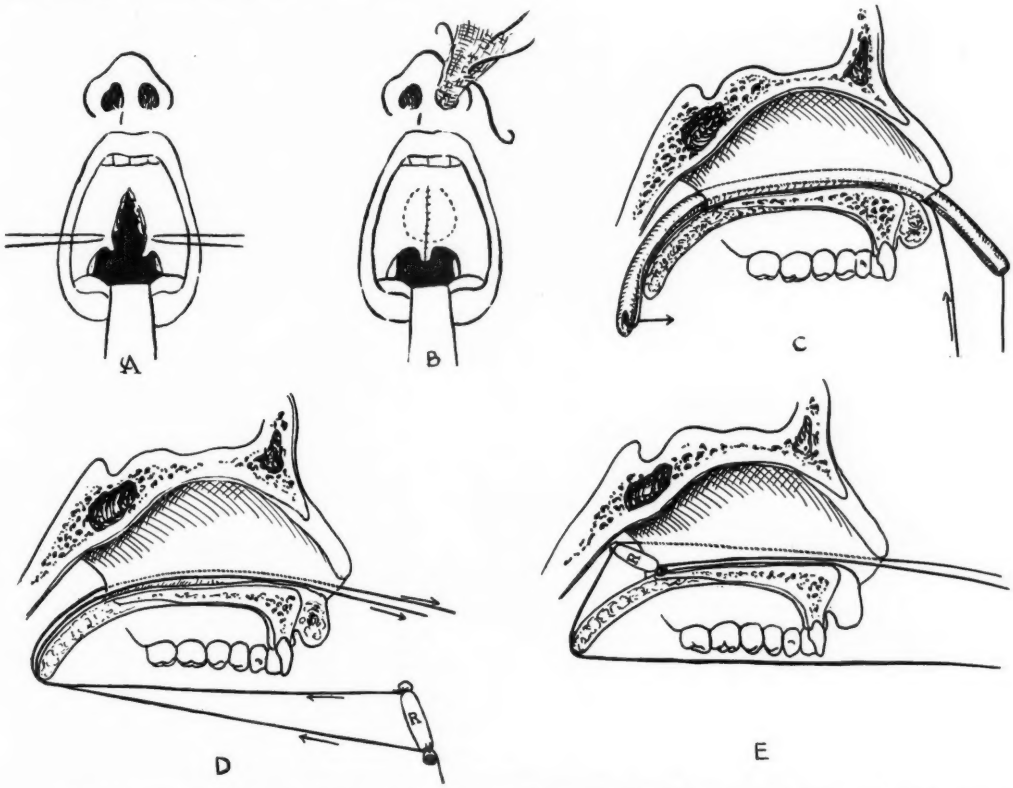

Fig. 8.—*A*, Diagram of method of splitting the soft palate so that direct access is given to a lesion in the vault of the nasopharynx. After access is given, the lesion may be attacked with the diathermic knife, loop, or radium foci may be inserted or laid over the lesion and held in place with a gauze pack. The strings attached to the radium needles or tubes along with the tail strip of the gauze pack are stuck out through the nostril. Several days later the two can be removed.

B, Immediately after an operation or excision or the application of radium, the soft palate is carefully stitched together using suture for the mucosa above the velum and a Lembert type of suture which gives muscular coaptation as well as ventral mucosal coaptation.

C, Diagram of method of placing radium tube in the nasopharynx. A catheter with a string attached is passed through the nose and pulled out through the mouth below the palate. The catheter is then pulled back out, and a radium tube attached to the string as shown in *D*. The string is tightened and pulled into the nasopharynx as shown in *E*. The string may be tied to the front of the lip if desired.

Although several men have devised rather complicated apparatuses to give direct surface radiation from within in this region; when radium is to be applied from within, interstitial insertion is usually the most efficient method. Only when the area is definitely outlined, however, and easily exposed so that

there is no question about the distribution of the foci, should one depend upon the insertion of the radium from within the mouth. As previously mentioned, in these lesions Ledoux of Brussels has advocated direct application of radium by access surgery after a primary resection of the angle of the jaw and part of the ascending ramus, on the basis that exposure is good and the danger of bone necrosis is eliminated.

Hypopharynx.—After it has been decided that radiation methods are the ones of choice for a given case of epithelioma of the hypopharyngeal region, some plan must be decided upon which takes into consideration that the lesions in this region—especially the pyriform fossa—are very radioresistant. Coutard's results by external irradiation for growths located in this region are the least

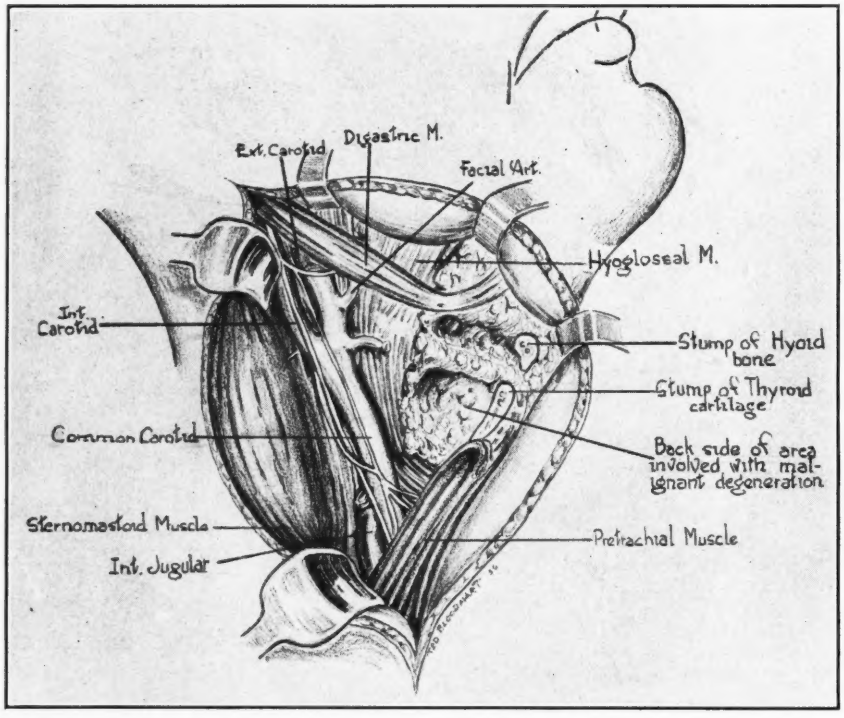

Fig. 9.—Diagram of lateral neck exposure. All areolar tissue, glands, deep jugular vein from the lower neck to the mastoid process region, have been removed after retracting the sternomastoid muscle. Only in those instances in which the glands are not already enlarged because of metastatic cancer would one consider not leaving the sternomastoid muscle. When the glands show gross evidence on section of cancerous involvement, a complete bloc dissection of the neck should be done. This involves removing the sternomastoid muscle, the deep jugular vein, etc., en bloc. Only nerves and carotid arteries are unmolested. The greater cornu of the hyoid bone and the outer wing of the thyroid cartilage have been removed so that a direct approach is gained to the lower lateral wall of the pharynx.

favorable of any. Therefore, if a cure is to be effected, a plan must be worked out which theoretically at least allows one to apply a lethal dosage. Often the most intensive external radiation is insufficient. Internal application of radiation by interstitial methods is almost impossible because of the difficulty of accurate placement.

Here a surgery of access may be advocated so that theoretically at least a dosage of radiation calculated to be lethal may be given (Figs. 9, 10 and 11). As one does this surgery of access to expose the lateral wall of the pharynx, a

bloc dissection of the neck may be done. Usually the bloc dissection at one time or another will be definitely indicated, and not uncommonly it will be found that the glands of the neck already are involved. After the internal jugular vein, areolar tissues, and lymphatic structures along the carotid arteries have been removed from the lower neck to the mastoid process, the muscles over the thyroid cartilage and the greater cornu of the hyoid are removed. By this method the danger of cartilaginous damage is eliminated and besides one comes down directly on the newgrowth. The alae of the thyroid cartilage and if needs be the cornu of the hyoid bone are removed. The mucosa beneath is palpated. When exploration would seem to offer more confirmation as to either the chances of excision or aid in judging as to placement of the foci of radiation, the mucosa of the lateral pharyngeal wall is incised, after which a palpating finger is inserted within the pharynx. If the lesion is judged to be beyond offering a hope of cure if totally removed, the

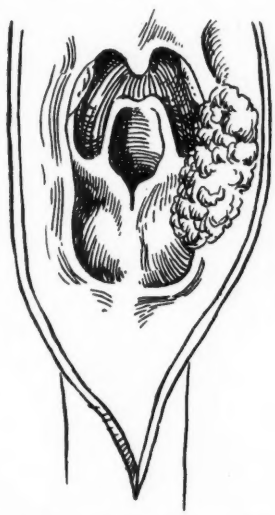

Fig. 10.—Diagram showing location of a malignant ulcer for which an exposure such as shown in Fig. 9 might be indicated. Viewed from the back.

incision should be closed. Needles or seeds are then laid or inserted along the side of the pharynx just external to the lesion. A gauze pack holds the needles in place until the time for removal. The main vessels should be protected by the interposition of rubber.

Some men state that radon seeds can be implanted accurately enough through the direct laryngoscope to be of value in lesions located in the hypopharyngeal region. In my experience neither adequate knowledge of the extent of the lesion nor a proper distribution of the radon foci is obtained by this method.

When surgery of access of the type described is contemplated as the method of caring for local lesions in this region, it is a close question whether to give external radiation preoperatively or postoperatively. When heavy external radiation is given preoperatively, the surgery of access is more difficult, and possibly the patient's general condition for an operative procedure will be unfavorably affected.

The Neck.—When the lymph glands of the neck are involved by metastatic squamous cell carcinoma and complete removal would appear to be likely or even a possibility, they should be removed. Although in a general way this is the routine procedure in the majority of better clinics, a more conservative policy has been adopted by some. Some clinics maintain that whenever the capsule of the lymph node has been penetrated by obvious cancer, excision en bloc is of no value. Our policy has been somewhat more radical. Whenever the carotid artery is free from a unilateral metastatic mass, even if the mass was somewhat fixed to such a structure as the lower edge of the mandible, operation has been advised. After cancer of the lip, bilateral glands have been considered as having a chance of a cure on complete removal. When the glands were attached

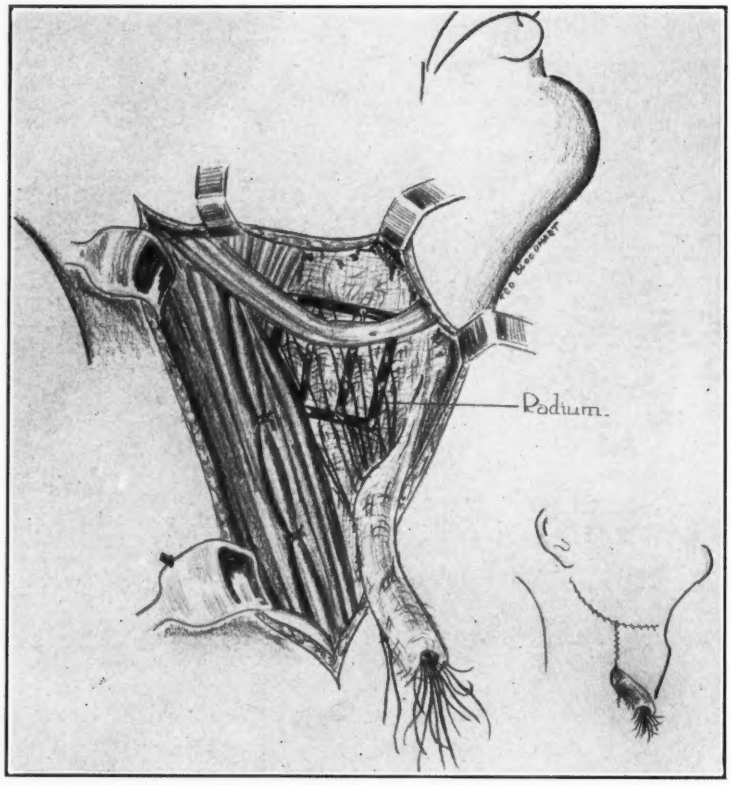

Fig. 11.—The sternomastoid muscle has not been removed in this instance. It is therefore sutured to the pretracheal group up part way. A few stitches are taken to hold the posterior digastric belly to the upper part of the sternomastoid muscle. Radium foci on gauze have been laid directly over the area to be treated. Several layers of gauze are superimposed over radium foci. Gauze and radium may be removed after the radium has remained in place for a sufficient length of time.

to bone, usually a thick parallel layer of bone was removed along with the mass. In most instances, the later situation was encountered after the healing of cancer of the lip.

In those individuals with metastatic glands to the neck which are beyond the possibility of a cure or even palliation by excision, the method most likely to give temporary palliation for a varying period of from six months to several years is the application of interstitial foci of irradiation through the mass in a sufficient amount to be lethal from the theoretical standpoint (Fig. 12). For a

part of the lethal dosage, external radiation by radium or the x-ray may be used according to preference, the type of radiation available, and sometimes the location and extent of the lesion to be treated.

Some workers have advocated a partial exposure of the metastatic mass so that the foci could be inserted with more accuracy into the mass or laid directly upon it. Whenever it would seem that accurate localization of the foci was improbable or impossible, some surgery of access certainly would seem a wise procedure. In a considerable number of metastatic lesions of the neck, however, the size, position, and location are such that little is gained by turning back the skin or retracting a superimposed muscle.

Fig. 12.—Diagrammatic photograph of method of applying interstitial radiation with radium needles to an inoperable metastatic lesion of the neck.

When it is evident that the disease has advanced to a point where no hope of a long period of comparative freedom from symptoms seems probable, external radiation of a sublethal character theoretically may be of some value. Now one hopes to make the patient more comfortable and, knowing that his days are numbered, does not put him through the discomfort of the intensive radiation required when lethality for all the tumor cells is striven for.

CONCLUSIONS

It would seem well to point out that although a description has been given of effective methods of applying radium in oral cancer, the problem of the relative indications for radium therapy has been touched upon only very lightly.

As a therapy for some of the lesions described, surgery offers as much or more and in others a combination of radiation and surgery has been adopted in some clinics as the method most likely to produce the highest percentage of cures in the aggregate.

The relative indications for the use of the weapons for attack against oral cancer is quite a long story.

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SOME OBSERVATIONS ABOUT INITIAL LESIONS OF ORAL CARCINOMA

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A GREAT deal of blame has been placed on irritation from broken-down teeth, dental restoration, ill-fitting dentures, and oral sepsis as the causes of carcinoma. It therefore should be of interest to find out whether carcinoma occurs in well-cared-for mouths in which there is no mechanical irritation present. Before doing so let us first scrutinize the statements so commonly made by clinicians regarding the interrelation referred to above.

Only 10 per cent of the population receive regular dental care. Of the remaining 90 per cent, the larger part never visit a dentist or dental clinic, although a few may occasionally seek emergency treatment. Patients seen in all hospital clinics belong to the class that notoriously neglect their teeth, and it is therefore no wonder that almost all hospital patients who have oral carcinoma present also all kinds of dental defects and mouth diseases.

Another important consideration is the fact that most clinic patients do not apply for treatment until the lesion is large. It has then become exposed to trauma during mastication, has come in contact with broken-down roots, and through malhygiene has become ulcerated and infected. These conditions therefore are more likely to be secondary in nature than a primary etiologic factor.

Let us now consider another statement frequently made—that carcinoma does not occur in the well-cared-for mouth. It might be pointed out, first of all, that early carcinoma is not easily recognized, and, second, that most dentists either ignore small lesions on the mucosa of the mouth, lips, tongue, and palate, or do not even look for them. If they do find and remove them, they neglect to have the tissue examined pathologically. It is also a well-known fact that even large cancers may go unrecognized. They are often treated with silver nitrate, or various antiseptics; and, if teeth become loose, these are extracted because they are thought to irritate the parodontal structures. If extensive cancerous lesions are thus mistaken for parodontal pyorrhea, it is not surprising for the idea to spread that carcinoma forms from inflammatory, so-called precancerous, lesions.

While carcinoma indisputably may develop from the use of a pipe or tobacco, from leucoplakia, and from odontogenic cysts in cancer-susceptible individuals, I feel that it should be pointed out that it may also form as a small inconspicuous lesion which is a cancer from the start without being preceded by inflammatory overgrowth or hypertrophy of the mucosa, so commonly found in the oral cavity as the result of chronic irritation and infection. The three following cases presented carcinoma as a very small lesion of short duration occurring in perfectly clean, regularly and well-cared-for mouths, with no dental defects and produced without the presence of mechanical irritation.

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CASE 1.—Epidermoid carcinoma, Grade III, of the cheek.

This patient, male, aged seventy-one years, had not noticed any abnormal condition connected with his mouth. He had received regular dental care all his life; his mouth and teeth were in very fine condition. At a periodical examination his dentist discovered a small nodule on the buccal mucosa when retracting the cheek. The patient stated that he had noticed it for four to five weeks, occasionally biting it, but that it had not started from that cause. Indeed there was no visible lesion.

Pathologic examination of the lesion excised in toto, showed a very small area of keratinized epithelium on the surface of the mucosa. From this cords

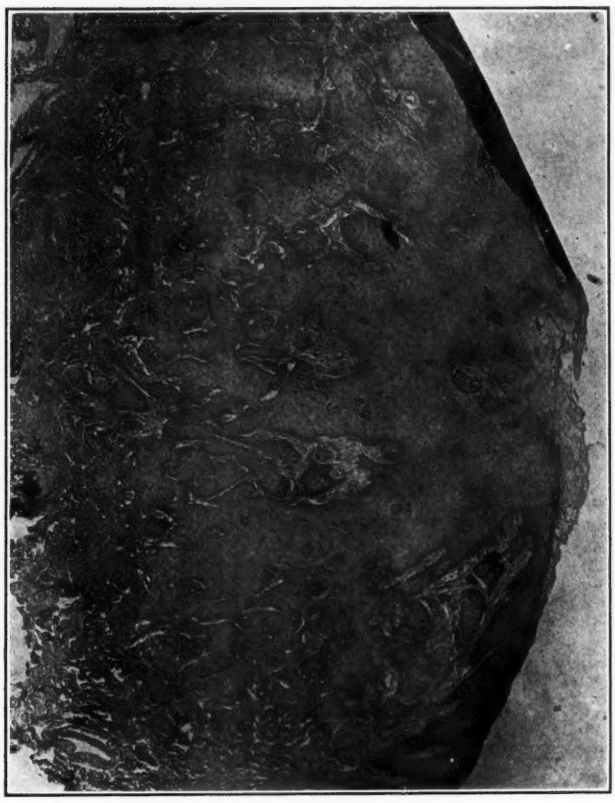

Fig. 1.—Carcinoma of the cheek, early lesion.

of the tumor cells extended into the underlying connective tissue without infiltrating the buccinator muscle (Fig. 1). There is no recurrence to date (three years).

CASE 2.—Epidermoid carcinoma, Grade II, of the palate (reported by Thoma, *Clinical Pathology of the Jaws,* Case XII, E, 16, p. 598).

The patient was referred to me because she had noticed a very small painless ulcer on the palate just posterior to the incisor teeth. For years the patient had been in the hands of one of the very best dentists, and her teeth and mouth were well cared for and in perfect condition. The pathology had progressed more than superficial examination disclosed, x-ray examination showing exten-

sive bone involvement. Operation was refused on account of age, feebleness, and poor heart condition. Later, when a tooth had to be extracted on account of malocclusion caused by the tumor growth, tissue was excised for pathologic examination; this confirmed the diagnosis. She received careful hygienic care and in spite of progressive facial deformity had not a great deal of discomfort, requiring little medication. She died at the end of the tenth month.

Case 3.—Epidermoid carcinoma, Grade III, of the floor of the mouth.

This patient, a man aged fifty-seven years, came to me in May, 1933. Two months ago when he lived in Buffalo he had noticed a white pimple under the tongue. It had never produced any discharge or given any discomfort. He consulted a dentist who "touched it up" every day until a month ago, believing it to be a calculus. He noticed the lesion when moving his tongue, though

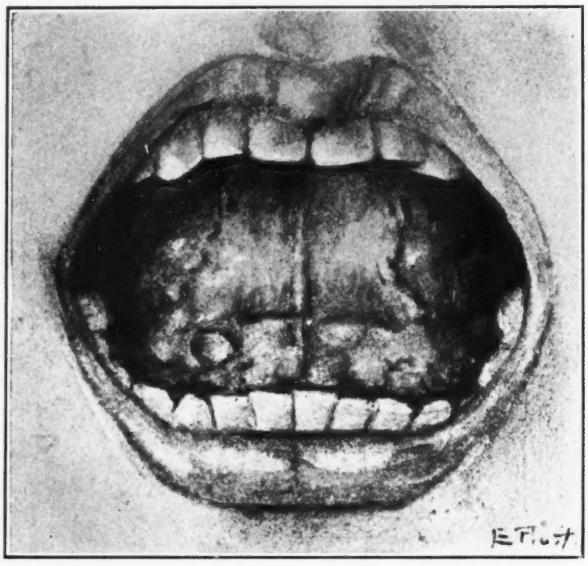

Fig. 2.—Carcinoma of floor of mouth, early lesion.

it did not pain or give discomfort. The patient saw three doctors recently who thought it was an innocent ulcer. He was referred to me for an opinion.

Examination showed a well-cared-for mouth, no gingival inflammation, leucoplakia, or dental neglect. He smoked a pipe moderately (six pipefuls over twenty-four hours). A small, oval, depressed ulcer with shiny surface was visible under the tongue over the right sublingual salivary gland. There was no induration; the sublingual and submaxillary lymph glands were not enlarged, and the lesion seemed to involve the surface of the mucosa only Fig. 2). The patient was afraid that it was a carcinoma; as a matter of fact, he had a cancer phobia, and because of this mental attitude more than anything else, I advised excision and pathologic examination.

I excised the ulcer with a margin of the normal mucosa for safety, including part of the sublingual gland. After removal of the tissue the wound was treated with sclerosing solution (Carnoy's solution with ferric chloride), and closed with sutures.

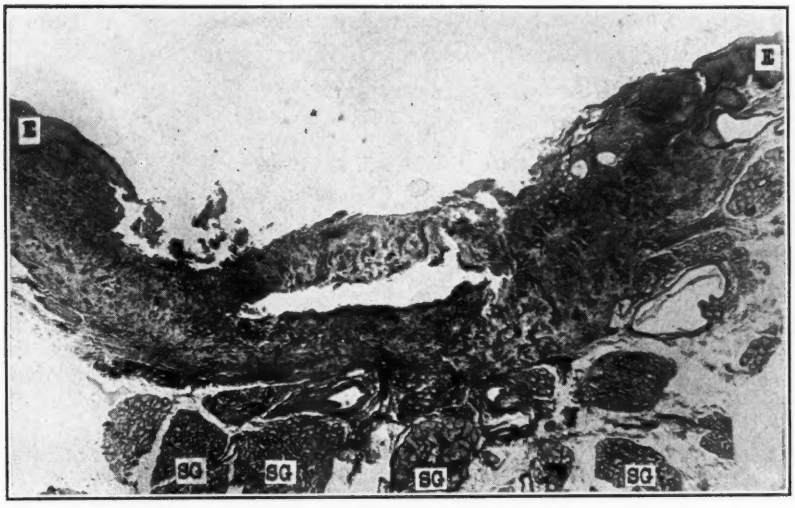

Fig. 3.—A photomicrograph of excised carcinoma of floor of mouth shown in Fig. 2. *E*, Epithelium of normal mucosa; *SG*, sublingual salivary gland.

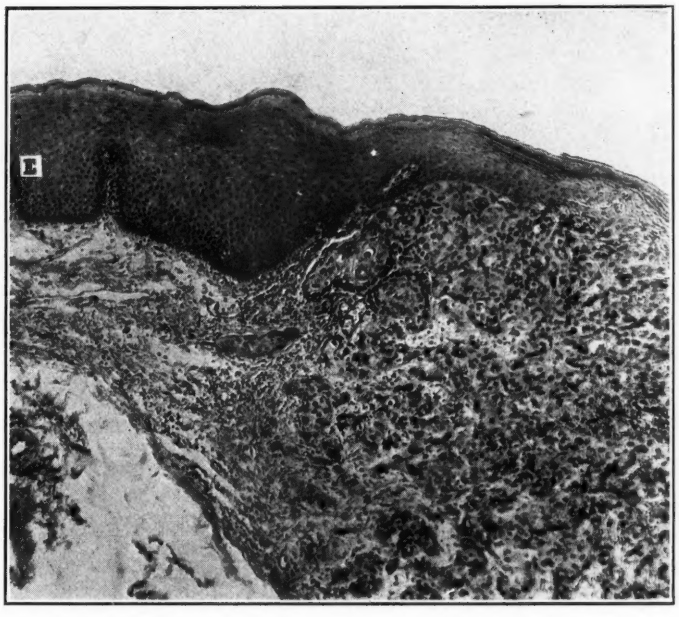

Fig. 4.—Photomicrograph, high magnification, of left margin of carcinoma; *E*, epithelium of normal mucosa.

Pathologic examination of the excised tissue showed it to be a very small carcinoma, growing from the margin of a depressed area in the mucosa. The entire tumor was contained in the specimen, and the mucous glands in the lower part were not involved by the disease (Fig. 3). The type of tumor growth shows a decidedly infiltrating form of undifferentiated, very malignant cells with frequent mitoses, though occasionally hyperplastic cells are seen which form tabs and pearls (Figs. 4 and 5).

Additional treatment seemed indicated to safeguard the patient from recurrence. As he resided in New York at the time, I advised him to have deep radiation therapy, which he applied for and received. I saw the patient in April, 1936, when there was no recurrence (three years).

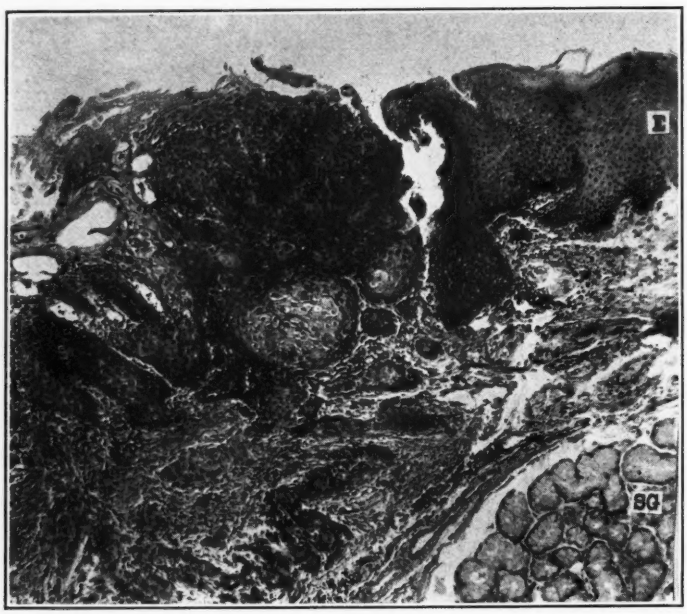

Fig. 5.—Photomicrograph, high magnification, of right margin of carcinoma; *E*, epithelium of normal mucosa; *SG*, sublingual salivary gland.

SUMMARY AND CONCLUSIONS

1. Carcinoma may occur in well-cared-for, clean mouths, unrelated to chronic irritation.

2. Carcinoma occurs without being preceded by a precancerous lesion, and is difficult to diagnose.

3. It is important therefore to excise for prophylactic reasons all small lesions, no matter how innocent, in patients who have reached the cancer age. The excision should extend well into the uninvolved tissue with a margin of safety, and be treated by coagulation or application of a sclerosing solution immediately after removal. All such specimens should be sent to a pathologist for diagnosis.

4. If the lesion proves to be carcinoma, the patient should receive radiation therapy as an additional safeguard.

47 Bay State Road

THE DIEFFENBACH-WARREN OPERATION FOR CLOSURE OF THE CONGENITALLY CLEFT PALATE*

VILRAY P. BLAIR, M.D., F.A.C.S., AND JAMES BARRETT BROWN, M.D., F.A.C.S., ST. LOUIS, MO.

THIS operation is commonly called after Bernard R. K. von Langenbeck; but, as it is a fundamental contribution, it might seem fitting that it recall two men who, rather simultaneously, worked out and put into execution, a successful plan for closing congenital palate clefts, that has never been superseded and, as far as known history records, was basically original.† There have been modifications or substitute plans, but, as a class, these are more difficult of execution and, with the exception of the "push-back," type which in this country has been developed by Dorrance, as a rule, show less regard for normal anatomical arrangement or for possible serious damage to developing bones and teeth.‡

While hygiene of the mouth, nose, and middle ear, and the later facilitation of dental prosthetics should be sufficient reasons for the closure of the open palate cleft, the driving motive for the operation is the desire to improve the faulty speech. In its last analysis, the modifications and interruptions of the vocal sounds essential to enunciation are just as dependent upon muscle action as is the act of walking. An inert dental prosthesis or a repair from live extraneous or passive tissues can be made to supplement a deficient palate, just as walking can be aided by an artificial limb, but, to function, each requires that it be under some indirect muscle control.

While the common designation mentions only the cleft, such a palate is usually short anteroposteriorly and without sufficient compensating hypertrophy of its essential muscles to control the air leakage. Clinical evidence of a prevalent muscular deficiency comes from the occasional case in which there is normal speech with a wide open cleft, together with the fact that in the majority of cases, enunciation can be improved still further by speech training subsequent to closure of the cleft. Chalmers Lyons is gathering confirmatory laboratory evidence. Judged by the relatively late period at which the average cleft palate child attempts to talk, a muscle deficiency and also the open cleft might primarily be dependent upon some derangement or blight

*From the Department of Surgery, Washington University School of Medicine, St. Louis, Missouri.

†The operation of bridging the cleft of the hard and soft palate by means of mucoperiosteal flaps raised from the undersurface of the hard palate through lateral incisions, mobilizing the two halves of the velum by dividing the palate aponeurosis with its overlying nasal mucosa and then freshening and suturing the borders of these flaps, was first described in 1828 by Dieffenbach. In 1842, Warren reported several cases in which operation was done by the same general plan but the lateral incisions were omitted. Muetter, in 1843, reported 21 operations on the hard and soft palate, apparently using lateral incisions (1).

‡The "push-back" operation is applicable only to partial clefts and may be indicated only when the palate is particularly short.

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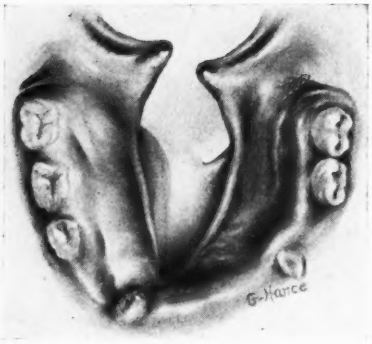

Fig. 1.

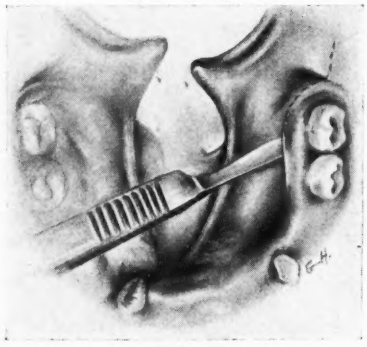

Fig. 2.

Fig. 1.—A somewhat distorted representation of an average left-sided single complete cleft of the palate in which the alveolar borders have been approximated and the anterior part of the palate cleft has been narrowed by pressure of the lip and cheeks as the result of the closure of the lip cleft some months previously. The distortion mentioned is not of any particular structure, but in the relationship of the two component halves to each other. For the better display of the subsequent sequential steps and at the same time to accentuate the relation of each maneuver to the palate as a whole, in the above illustration each separate half of the palate and the related alveolar process is represented as if viewed along an axis more nearly vertical to the palate process than to the palate as a whole, that is, as if each half were viewed individually. This gives an opened out appearance with greater transverse width than is normal.

Fig. 2.—Mobilization—Dieffenbach's approach. As here presented, the first and the characterizing step of the Dieffenbach operation is a lateral incision through the mucoperiosteum down to the bone in the molar region, which, when extended behind the maxillary tubercle, severs the continuity between the lateral border of the soft palate and anterior faucial pillar from the buccal mucosa. The knife being held oblique to the sagittal plane, its point contacts with the alveolar bone just above the necks of the teeth. The line of the incision is along the base of the gingiva, the fringe itself and its relation to the necks of the teeth being undisturbed. The point of the knife scratches along the bony surface of the alveolar process touching neither the necks nor the crowns of the teeth and avoiding the trunk of the major palatine artery by a wide margin. All the soft tissues down to the bone are cut as the blade is pushed backward, the line of the cut curving outward between the maxillary tubercle and the hamular process. Behind the hamular process, the axis of the knife handle shifts to parallel more nearly the sagittal plane, the blade cutting deeply in the direction of the pterygomandibular ligament, the point being kept median to the anterior border of the mandible. The exact position of this cut, both on the surface and in its depth, should be first visualized and then accurately made with one purposeful stroke.*

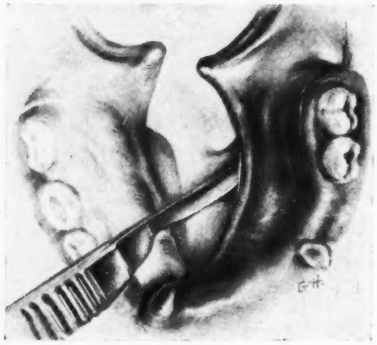

Fig. 3.

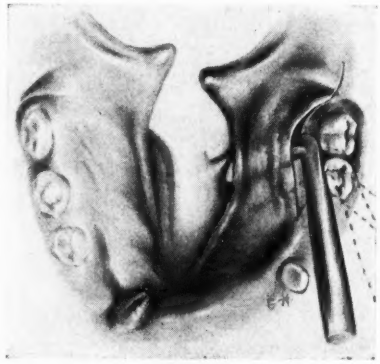

Fig. 4.

Fig. 3.—Mobilization—Warren's approach. On the uncleft side where the nasal septum becomes continuous with the palate process, time and tissue will both be saved by making an incision through the septal mucosa parallel and close to its junction with the palate tissue. If the palate cleft were unduly wide in its anterior part, more of the nasal mucoperichondrium might be included in the palate flap, but this is seldom necessary in single clefts and is not practicable in double clefts. The extreme anterior part of this incision is sometimes made by inserting a small blade through the nostril on the cleft side or with the cutting edge of a sharpened Brophy elevator, but, for the present, that much of the incision as here indicated will suffice.

Fig. 4.—Mobilization—elevation of the mucoperiosteal flaps. The point of the angle elevator enters the lateral incision just in front of the postpalatine foramen, and then by slight rotary movements of the shaft and by picking up the periosteum from the palate process, the point is worked toward the midplane until it pierces through the line of incision at the base of the nasal septum and protrudes into the cleft. By changing the angle at which the shaft is held, and working a bit forward, the mucoperiosteum and, with it, the posterior palatine artery can be freed from the underlying bone as far forward as the incisive foramen. The artery, in its course forward, may lie deeply embedded in a groove on the undersurface of the palate process, from which it is to be dislodged by working the point close to the bone.

*See opposite page for footnote.

in the nervous mechanism, just as marked congenital deficiencies of the external ear are frequently an expression of a blight somewhere in the auditory tract or its connections.

The greatest adjuvant to the short passive palate is a muscle band in the upper part of the superior pharyngeal constrictor, which can act as a half purse-string in closing off the nasopharynx. With a deficient palate, overaction of this strand may draw forward a thin, shelflike fold of mucosa commonly called Passavant's pad and the degree to which this plica is developed before operation can be taken as a rough indication as to quality of the postoperative speech results. This necessity for developing the crippled musculature in no way minimizes the indications for proper operative closure but emphasizes the importance of not further hampering the already deficient muscle power.

Fig. 5

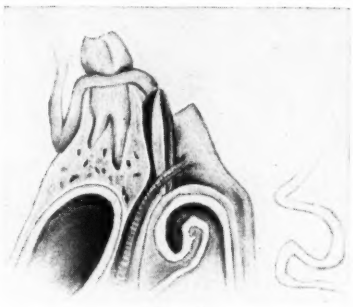

Fig. 6.

Fig. 7.

Figs. 5, 6, and 7.—Mobilization—major palatine artery. Figures 5, 6, and 7 are diagrammatic representations of a transverse section through the maxilla made just posterior to the contents of the descending palatine canal viewed from behind. Fig. 5 shows the point of the elevator bit as it first enters the lateral incision near the posterior border of the hard palate. In Fig. 6 the point of the elevator bit has been pushed palate-ward encountering the palate process. By rotation of the shaft, the point of the bit can be made to raise the submucous part of the artery out of the posterior end of its groove. Fig. 7 shows the relation of the elevator bit to the palate tissues, the artery and the bone, just as the point of the elevator bit is about to emerge into the cleft (Fig. 4).

Even when the operative procedure is technically correct, which presupposes preservation of an adequate blood supply, sufficient mobilization without damage to essential structures, and proper coaptation of the denuded borders,

*In the original Warren operation, the elevation of the mucoperiosteal flaps is done from the cleft border, the elevator working laterally toward the base of the alveolar process. Some advocates of the Dieffenbach operation have criticized this lateral incision on the theory that it necessarily cuts essential muscles and nerves. Such a criticism can be honestly made only through a lack of understanding of its purposes and of the related anatomic structures. It not only can be made without crippling any essential structure but allows the greatest relaxation of the palate tissues with less risk to the major palatine artery and permits of subsequent fixation and hemorrhage control, by lateral gauze packs.

complete or partial failure may be a not uncommon result, from either lack of primary union or lack of good function. Granting all the above, failure of union is almost always due to infection, and its occurrence can be lessened chiefly by control of local foci, by having the patient in good condition, by avoiding periods of prevalent respiratory infections or the exanthemas, and,

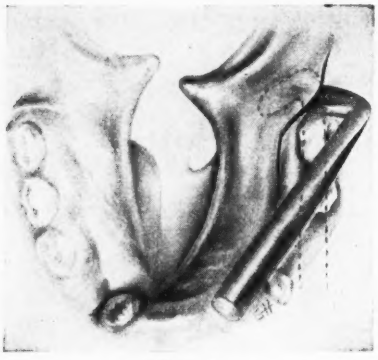

Fig. 8.

Fig. 9.

Fig. 8.—Mobilization—elevation of the mucoperiosteal flaps. Having completed the elevation of the mucoperiosteal flap from the palate process, the angle elevator is next inserted into the lateral incision between the hamular process and the maxillary tubercle, well behind the trunk of the palatine artery. The shaft is then rotated, and the bit, passing behind the base of the hamular process, is pushed toward the median plane, tunneling a path that parallels and somewhat approximates the posterior border of the palate process.

Fig. 9.—Mobilization—elevation of the mucoperiosteal flaps. Using the point as a fulcrum, the shaft is rotated so as to swing the heel of the instrument toward the midplane, the velum tissues being forcefully pushed in that direction.

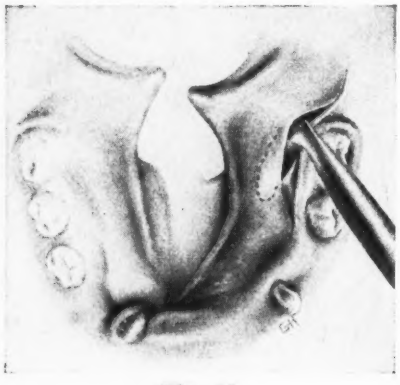

Fig. 10.

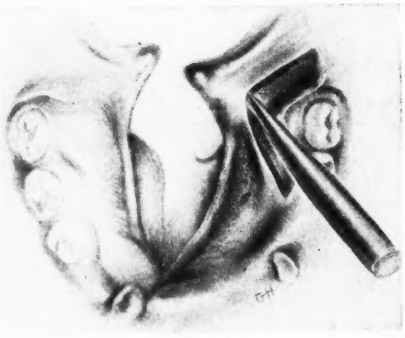

Fig. 11.

Fig. 10.—Mobilization—elevation of the mucoperiosteal flaps. The palate flaps, consisting of the mucoperiosteal covering of the hard palate in front and of the velum and fauces behind, have now been fairly well freed laterally both anteriorly and posteriorly but are still bound to the alveolus by some firm tissue just median to the maxillary tubercle. This might be dissected free with a knife but more safely by stretching it with the heel of the angle elevator.

Between the posterior palatine foramen and the point at which the artery enters the substance of the mucoperiosteal covering of the palate bone for a distance of some 3 to 5 mm., its trunk traverses the plane between the hard and the soft tissues and lies somewhat free and enveloped in loose connective tissue. It is this anatomic arrangement that permits the palate flaps to be shifted bodily inward and still preserve the blood supply. Retaining this blood supply at least doubles the chances of a successful closure. To do this, the bit of the elevator is reinserted so that it lies just within the anterior part of the incision, its heel approximating the maxillary tubercle and the point lying along the base of the alveolus.

Fig. 11.—Mobilization—elevation of the mucoperiosteal flaps. A rotation of the elevator as described under Fig. 9 is now repeated. The procedure thus far depicted should be carried out on one side in a few minutes, and our observations have led to the belief that speed tends greatly to lessen the essential risks of this operation. The above is likely accompanied by quite a bit of bleeding, which, if too severe, can be controlled at any stage by finger pressure with a gauze pad on the palate tissues. If, however, the main artery is not cut or torn, one can usually go through to completion and then control bleeding by packing the wound.

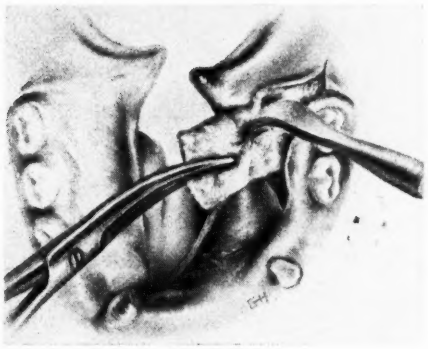

Fig. 12.

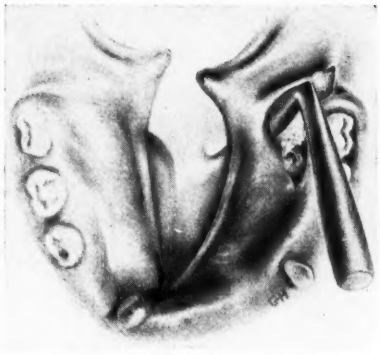

Fig. 13.

Fig. 12.—Hemostasis. The bleeding is now controlled by packing. This is done with a strip of gauze 4 to 6 folds thick, 2 cm. to 2.5 cm. wide and 3.5 to 5 cm. long; one end is forced deep into the velar tissues, filling the posterior half of the lateral incision by means of the curved-on-the-flat elevator.

Fig. 13.—Hemostasis. About half the strip having been disposed of as shown in Fig. 12, the other end of the strip is passed under the mucoperiosteal palate flap in front of the descending palatine artery, and the remaining loop of pack is stuffed into the incision external to the trunk of the artery.

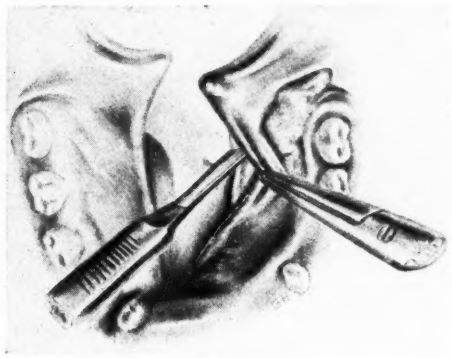

Fig. 14.

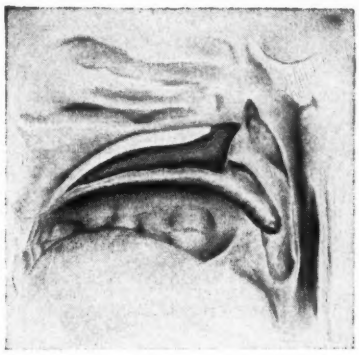

Fig. 15.

Fig. 14.—Mobilization—division of the palate aponeurosis. This may be done with either a curved scissors or a small sharp scalpel; the latter is the more accurate method, but the former may be more applicable to clefts extending but a little way forward from the velum. Inserting a sharp hook or the needle-pointed puller into the free median edge of the liberated palate flap, drawing the latter toward you, the tense palate aponeurosis and the mucosa covering its nasal surface are cut with the knife point along the posterior border of the palate process is far as one can see, which may be but a few millimeters on the first hold. Catching the palate edge farther back at each knife stroke as the flap becomes freer, more of the field continuously comes into view.

In this way one can extend the incision back to the eustachian cushion if need be with the actual field of incision always in view. If, in the lateral pharyngeal wall, one cuts a fair-sized artery, it is caught with a heavy crushing Ochsner and, if practicable, tied with a simple ligature or suture on a curved needle. This bleeding, however, usually can be controlled after crushing the vessel, by rearranging the lateral packing so that the posterior end of the folded gauze extends into the nasopharynx just enough to rest within this lateral incision in the naso-pharyngeal wall. Whether the simple cutting of the aponeurosis and nasal mucosa along the posterior border of the palate bone gives sufficient relaxation or how far the cut must be extended along the lateral nasopharyngeal wall, is determined by repeatedly testing the relaxation with the needle-pointed puller (see Fig. 17).

Fig. 15.—Mobilization—division of palate aponeurosis. The elevation of the posterior part of the palate flap having been completed on one side and bleeding controlled, it is repeated on the other and the free median border of each flap is now examined. If the division of the palate from the nasal mucosa has not been completed to the posterior end of the palate process, whatever remains of this connection is divided with the point of the knife. This separation should go right to, but should not split, the velum.

Cutting the attachment of the palate aponeurosis and of the superimposed nasal mucosa along the posterior border of the palate process is the next essential step. This will complete the mobilization of the mucoperiosteal velar flap, allowing it to drop back toward the pharynx, downward toward the tongue, and median toward its fellow of the opposite side as shown in the cross-section (Spalteholz).

In relatively narrow clefts, the cutting of the palate aponeurosis from the posterior border of the palate process and with it the mucosa covering its nasal surface is sufficient. In wide clefts this incision is usually extended laterally to the nasopharyngeal wall, and backward in its mucosa toward the eustachian cushion, and may even include some of the fibers of the levator palati muscle before sufficient relaxation is obtained.

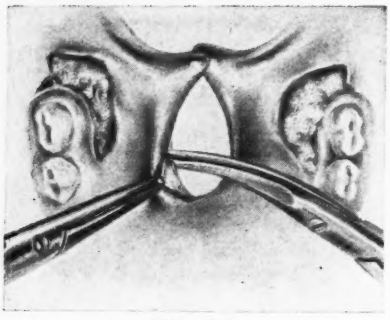

Fig. 16.

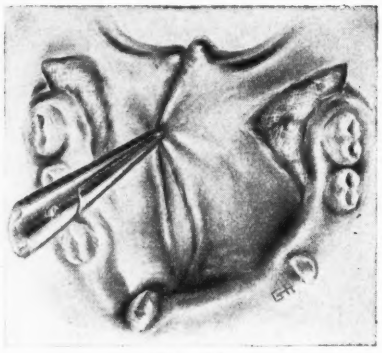

Fig. 17.

Fig. 16.—Mobilization—division of palate aponeurosis. In partial clefts the extensive freeing described under the preceding figure will not be necessary, and it will be found more convenient to divide the aponeurosis with a curved scissors on account of the limitation of the field of vision.

Fig. 17.—Mobilization—testing, posteriorly. If the junction of the velum with the mucocutaneous flap can be easily brought across the midline to meet its opposite, the latter lying in its natural position, then this part of the flap is sufficiently free.

Fig. 18.

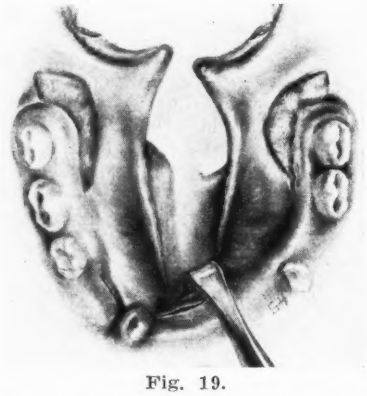

Fig. 19.

Fig. 18.—Mobilization—division of the posterior faucial pillars. Reinserting the needle-pointed pusher just proximal to the base of the uvula, the same test is repeated. If the posterior part of the velum is not sufficiently free, one further observes to determine whether it is the resistance in the anterior or posterior pillar. The former may be released by extending the original lateral incision further backward, or a tense posterior pillar is cut at its attachment to the pharyngeal wall with the knife or scissors, first putting it on tension with the needle-pointed puller, as shown in Fig. 18. If the cut is made close to the pharyngeal wall, very little of the palatopharyngeus muscle will be severed from its nerve supply and subsequent scarring will repair the defect in the pillar. Any arterial bleeding should be controlled before proceeding further, and this is best done with a suture of a double plain catgut strand on a palate-shaped strong needle. The double strand will preclude loss of the needle in the tissues, should struggling occur at the time of its insertion. If, so far, things have gone well and the child is in good condition, one may proceed to free the mucoperiosteal flaps at the anterior end of the cleft. To facilitate the suturing in this part, this freeing should extend to the edge of the gum or to the incisor gum fringe; and a short, somewhat transverse cut on each side, vertical to the cleft, may be of great help. (See Fig. 19.)

Fig. 19.—Mobilization—elevation of mucoperiosteal flap. Usually this is most easily accomplished with a sharp edged Brophy elevator with which one can divide the connection between the palate and the nasal mucosa and also raise the flap from the underlying bone. In freeing the median edge of the flap that covers the premaxilla, difficulty is encountered in the neighborhood of the incisive foramen. It may be of some help to insert the small knife through the nostril or to use the curved-on-the-flat elevator. We have ceased to do a palate repair on children under a year old, and by that time the incisor teeth are usually erupted, but it is to be remembered in using the Brophy elevator in this region that, if the mucoperiosteum is raised from over the bud of an erupting tooth, it may interfere with its further development.* If, however, after freeing the flaps at their nasopharyngeal attachments, there is a tendency for bleeding to persist, or if there is any other suggestion that it might be well to curtail the operation, one may now advantageously disregard the anterior part of the cleft and proceed at once to denude and suture the posterior part that has already been mobilized. After this suturing has been completed, the anterior part of the cleft may then be sutured or it may be deferred to some future time as the patient's condition dictates. Also, if either major palatine artery has been damaged, one should be very cautious about cutting around the anterior end of the flap of the damaged side, as some necessary blood supply or return might in this way be sacrificed.

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*Logan has shown that the buds of the premolar teeth lie in the soft tissues of the palate just mesial to deciduous molars where they might be damaged easily by injudicious use of either the knife or the elevator.

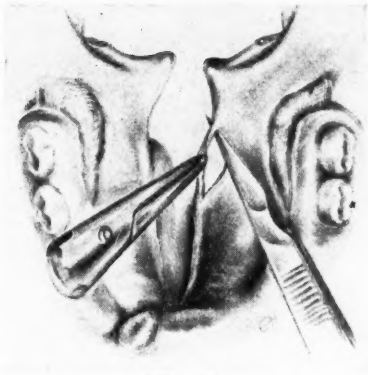

Fig. 20.

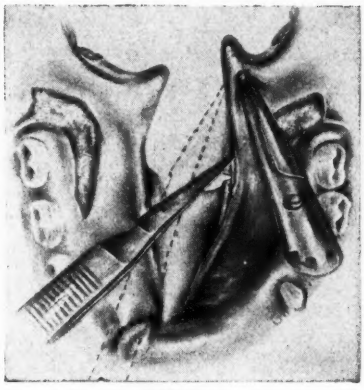

Fig. 21.

Fig. 20.—Denudation—of the cleft border by paring. The classic plan of freshening the cleft borders of the velum and uvula for suture is to cut off a thin ribbon of mucosa, but this is ordinarily an unnecessary sacrifice of tissue in an area already deficient, and we now resort to it only under one of three conditions: (a) when there is some reason to complete the operation in the shortest possible time; (b) when there is some special difficulty in getting at the field of operation; (c) in cases of two-stage or secondary operation after a previous failure Where the cleft borders are puckered with hard scar.

Fig. 21.—Denudation—of the cleft borders by splitting. In a primary operation, where the velum is accessible and where conditions are satisfactory, we follow the plan, used by Lyons, of splitting the mucosa of the border of the velum and uvula, and also of the posterior pillars if these latter are to be united (see Fig. 22).

The border of the velum is split deep enough to allow sufficient eversion of the edges to give a raw surface equal to its thickness. The cut will be a little deeper anteriorly than in the center, and only the mucosa is divided at the uvula. The undersurface of the base of the uvula is caught with the pusher as shown, or the base of the velum is engaged with the puller and the free border is split with a bistoury or a special knife. In this way the depth of the cut can be judged and controlled with considerable accuracy. As one cuts farther back, the pusher can be substituted for the puller. When things go nicely, this cut may be completed with one movement, the knife gradually paralleling the tense border of the velum, and smoothly slitting the mucosa as it is pushed back toward the apex of the uvula. On the other hand, it may prove to be a "catch-as-catch-can" performance, and one transfixes the velum to push or pull in any way that best serves.

Whether done by paring or slitting, both borders are examined throughout their full extent to see that everywhere they present sufficiently broad, cleanly cut, raw surfaces which can be easily approximated by the sutures. Much time will be lost and union may be compromised by attempting to unite ill-fitting parts. Any place in the velum where the mucous edge is rough or unmanageable can be judiciously undercut or pared. The area near the palate aponeurosis is particularly important. The borders of the mucoperiosteal flaps from the hard palate should first be examined with the rounded point of an artery forceps for any spicules of bone that might have been included with the flap, and any such should be removed. Next, any ragged edges should be trimmed, and one should be able to evert the edge of the flap toward the mouth even in its anterior extremity.

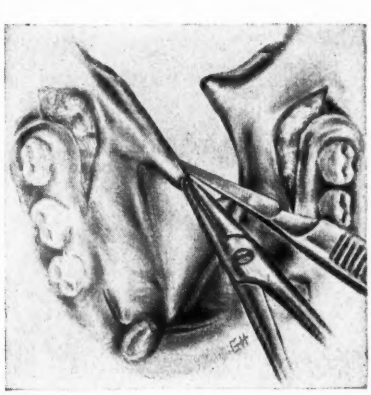

Fig. 22.—Denudation—splitting the posterior faucial pillars. In those past infancy, the palate can often be conveniently lengthened by continuing the denudation and the suturing to the adjacent parts of the posterior faucial pillars. To do this the anterior half of the border of each is split as shown, this cut being continuous with the velar slit at the base of the uvula, and farther back with the transverse cut in the body of the pillar. It is possible to unite the pillars sufficiently to interfere immediately or subsequently with nasal respiration and this must be borne in mind. Fig. 29 shows pillars sutured. When this is done, suturing of the nasal surface shown in Fig. 28 is omitted.

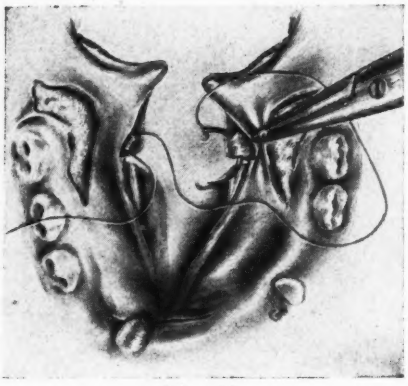

Fig. 23.

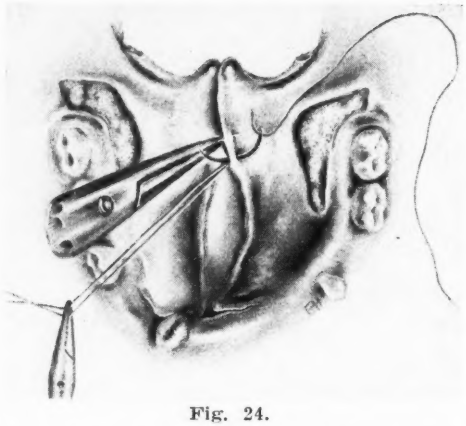

Fig. 24.

Fig. 23.—Suturing—the key suture. The first suture, which, with us, substitutes for any form of supplementary fixation, engages the fibers of the palate aponeurosis on each side. This being of tough fibrous tissue, a mild infection or drawing the suture too tightly will not cause it to cut through as quickly as in the softer structures. This type of stay suture is not so liable to do harm as are lead plates or circumferential tape, bands, or any other type of surface pressure.

The left border of the cleft is drawn forward with the puller, and the point of a full curved needle enters the raw surface near the oral border at the cut edge of the aponeurosis, digging 4 or 5 mm. into the substance of the velum to emerge posteriorly nearer the nasopharyngeal border. The right border is then caught with the puller, and the needle entering posteriorly near the oral border emerges near the nasopharyngeal border. The knot is tied at the nasopharyngeal surface. Both strands are caught with a light artery forceps (mosquito pattern) 10 or 12 cm. from the knot and dropped to the left of the patient's face. (See Fig. 24.)

Fig. 24.—Suturing—the velum. Starting just behind this first, the aponeurotic suture,[5] three or four interrupted vertical mattress sutures are placed in the velum, and the mucous edge on each side is in turn caught up with the pusher so that the needle will engage just 1 or 2 mm. of the edge.*

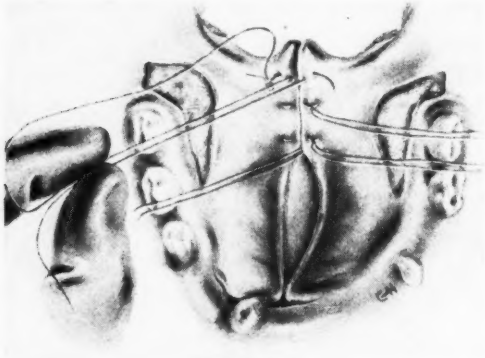

Fig. 25.

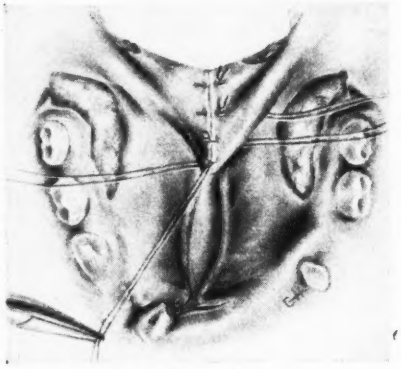

Fig. 26.

Fig. 25.—Suturing—the velum. Then drawing on this loop with the thumb and finger, the needle traverses both borders deeply, but not deep enough to include any of the mucosa of the pharyngeal surface. Each of these three or four deep sutures, as they are tied, are caught with forceps and dropped to the right of the patient's face. One or two simple mucosa sutures are placed on the undersurface of the uvula and one in its tip the free ends of these sutures, with the attached forceps being dropped in front of the patient's face. This brings the pharyngeal surface of the uvula and of the velum into view (Fig. 26).

Fig. 26.—Suturing—the uvula and upper surface of the velum. One or two mucosa sutures are placed in the pharyngeal surface of the uvula and, if the posterior faucial pillars are not to be united, two or three vertical mattress sutures along the upper surface of the velum.

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*For sutures we use a good quality of "live" horsehair both because it causes very little irritation and is, therefore, well tolerated by the tissues, and also, though it has sufficient strength to stand proper handling, it is apt to break if the knots are drawn too tightly. Each is cut 15 to 18 inches long, threaded at the proximal, the thicker end of the hair, tied in the eye with a single knot, and the protruding short end is cut half the length of the needle. There are microscopic scales on a horsehair, their free end directed distally, which make it easier to draw the hair through the tissues root-end first. If the hair is too long or too short, it will slow up the knotting. If the short end protrudes too far from the eye it will be in the way; if it is too short it may untie itself. Horsehair becomes untied easily and for this reason at least four knots are put on each suture as follows: the first with just sufficient tension to approximate the raw surfaces closely, the second so as not to disturb the tension of the first: the next two knots are tied with increasing tension so as to prevent untying.

especially with young infants, by carefully protecting the patient from contamination carried by the operator's breath or from the presence of some one with an acute coryza. That aseptic or antiseptic technic, as ordinarily interpreted, may have little bearing on the result, is suggested by pre-Listerian reports of series operated upon with fewer average failures than we can show today (Muetter's series). Of importance, is careful handling of the tissues

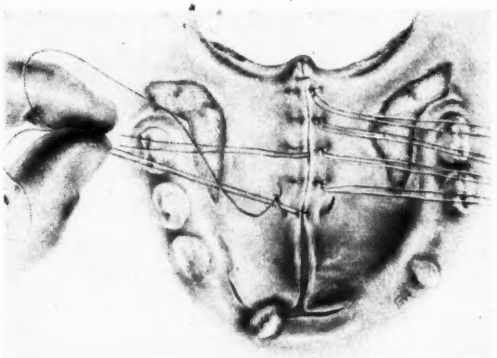

Fig. 27.—Suturing—the mucoperiosteal flaps. If needed ,the anterior end of the cleft border is now further mobilized. If the artery was damaged on one side, one might get by with extending the lateral incision on the sound side all the way forward until it connects with the cleft in front, thus liberating a tongue-shaped flap with its base at the major palatine artery, which can then be united to the other side with expectation of primary union. Where both descending palatine arteries are intact, one might raise such a tongue-shaped flap on either side and, after uniting along the cleft line, anchor the anterior free end, where convenient, with a few simple "tacking" sutures. This is mentioned by Arthur Keith,[6] who simply allows the freed flap to hang loose trusting to granulation and scarring to anchor the flap in its proper place to the undersurface of the maxilla. With the addition of the tacking sutures, this has worked satisfactorily in our hands, but we prefer, where possible, to leave at least a narrow attachment of uncut tissues anteriorly on one side. On the whole, however, if there is any doubt of the integrity of the major palatine arteries, it is safer to suture as far forward as the original relaxation will permit without tension and do the remainder at a subsequent operation, as a simple failure of union is much less a catastrophe than a slough or a distorted flap.

The mucoperiosteal palate flaps are united with vertical mattress sutures bringing several millimeters of the raw upper surfaces into contact. It is at the junction of the velum with the mucoperiosteal flaps that one is most liable to have a failure of union due either to insufficient relaxation or to deficient blood supply, and it is to be remembered that tight suturing interferes with blood supply.

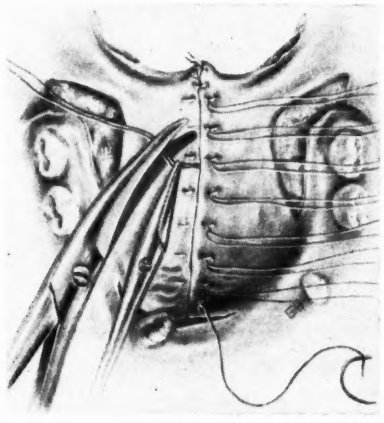

Fig. 28.—Suturing—mucoperiosteal flaps. The most anterior suture is tied with a long strand attached to the needle which latter is temporarily dropped in front of the patient's face.

Returning to the aponeurotic suture that hangs to the patient's left, both strands are caught in the tip of a pointed artery forceps 2 cm. from the knot, and the suture is cut just beyond. The beak of the locked forceps is then pushed into the nasopharynx, the jaws are opened to liberate the strands and the forceps is withdrawn, the suture remaining on the pharyngeal surface later to cut its way out. The exact circumstances of its subsequent expulsion we do not know, for we have never again heard from a single one of them. One could use chromic gut, but the knot would still be thrown off and the gut would cause more tissue reaction than the hair, in a place where the quickest possible union with the least disturbance is most desirable. If needed, an extra suture is added on the undersurface.

and of the patient, the prevention of excessive loss of blood, and of aspiration. The latter is greatly helped by operating with the patient's head hanging over the end of the table (the Rose position) and by suction. It is our belief that there is no postoperative plan of mechanical protection or support of the suture line equal to packing of the lateral incision with strips of gauze. This also helps to control bleeding and splints the palate, but the use of any one of these is not free from added danger, either to the patient or to the palate.

The most pertinent criticism that can be leveled at the original Dieffenbach-Warren operation is that it fails permanently to lengthen the intrinsically short palate. Brophy attempted to compensate for this by partially uniting the posterior faucial pillars and, on the average, produced the longest palates that we have had opportunity to examine. The posterior part of a palate thus lengthened, however, curves somewhat downward away from the plane of the pharyngeal muscular band mentioned, and thus must work at a mechanical disadvantage. To be of the greatest help, the lengthening should be in

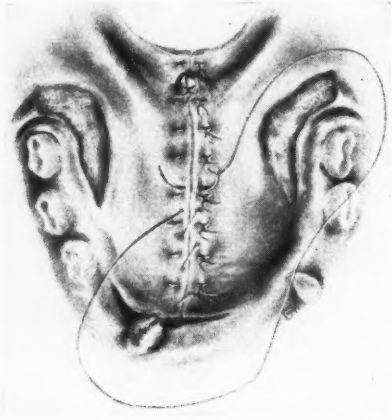

Fig. 29.—Suturing—approximating the mucosa. The needle carrying the anterior suture is again picked up and the mucous edges are accurately coapted all the way back to the base of the uvula with a light running suture which is cut 1 cm. beyond the last catch without knotting. The posterior pillars are shown to have been united.

A careful inspection of the suture line, for bleeding, and of the position of the packs, completes the operation.

Operation for a partial cleft is done on the same general plan except that where the cleft is very narrow and extends only a little way into the hard palate, a special aponeurotic suture is not necessary. One could conveniently close the velar clefts without making the lateral incision, the original Warren operation, by elevating the mucoperiosteum from the cleft with a Brophy elevator, but the palate aponeurosis should always be severed from the posterior border of the palate process, and packing inserted through the lateral incisions is a comforting prophylactic against bleeding. Furthermore, if, as far as possible, one sticks to a basic plan of operation, he will develop a better personal technic and better teamwork than if he yields to the temptation of making unnecessary variations.

the plane of Passavant's pad. When at the operation the velum is allowed to drop back by section of the palate aponeurosis, a raw area presents itself on the upper surface of the palate flap appearing from under the posterior border of the hard palate (see Fig. 15). As this heals, the velum again assumes its original position. We have attempted to prevent the secondary drawing forward of the velum by covering this raw area with flaps of mucosa turned from the cheek through the lateral incisions. This has given us some quite satisfactory results, but, on the average, the bleeding has been so severe

as to cast a doubt on the advisability of the procedure. Veau has varied the original procedure by not cutting the nasal mucosa laterally behind the bony palate, but undermining and stretching it without dividing the aponeurosis. The thought occurs that the indications which time may confirm for the more radical "push-back" modification will come, not simply from the fact that it lengthens the palate, but that the lengthening is in the plane of the constricting pharyngeal muscle band.

The basic factor for success or failure and which largely determines operability is the proportion of usable tissue to the width of the area to be bridged

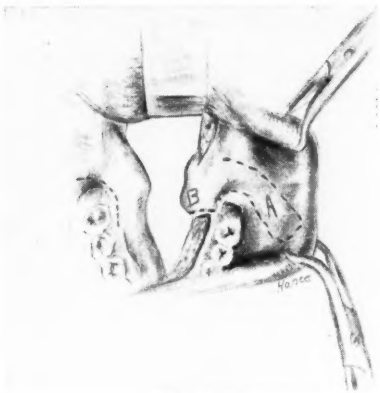

Fig. 30, *a*.

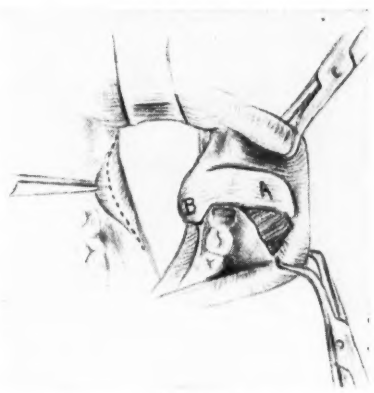

Fig. 30, *b*.

Fig. 30, *c*.

Fig. 30.—Secondary operation. *a*, A case in which there had been practically no closure of the cleft from previous operations, but a complete loss of the right mucoperiosteal flap and a very much shortened velum. The rough area in front of *B* indicates the palate process covered only by unusable scar. The dotted lines indicate a flap to be raised from the cheek to replace the right mucoperiosteal flap. *b*, The cheek flap has been raised, and, on the left side, a dotted line indicates the line of incision for splitting the cleft border and the posterior pillar. *c*, The cheek flap has been sutured into position to form the right half of the palate anteriorly and the two halves of the velum.

over. At the alveolar border, spare palate tissue is practically nil, so that here it is necessary directly to approximate the bones. This is most easily, safely, and accurately accomplished by pressure of the lip after repair of the lip cleft.[4] In the molar region the proportion of available mucoperiosteal flaps increases with the development of the unerupted teeth, so that in most instances conditions for closure will become satisfactory between one and two

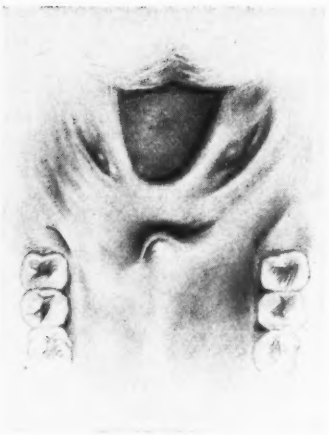

Fig. 31, *a*.

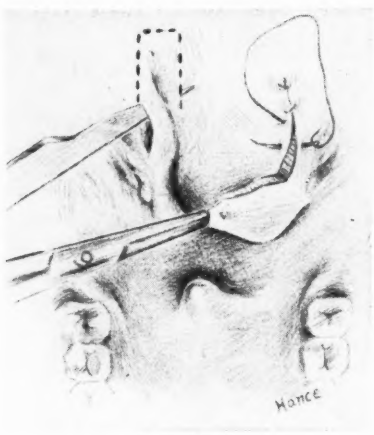

Fig. 31, *b*.

Fig. 31, *c*.

Fig. 31, *d*.

Fig. 31, *e*.

Fig. 31.—Secondary operation. *a*, Examination showed patient had had a flap turned from the right cheek to fill in the space between first molar and central incisor, going back to the base of the first molar on the left side. There is union everywhere with the exception of two places, one to the right anteriorly, and one to the left posteriorly. The uvula lies between the molars. Posterior pillars had been brought together for 1 cm. behind the uvula, but the opening between the nasal and the oral pharynx is 23 mm. from before backward and at the posterior pharyngeal wall is the same distance from side to side. Patient has some action of the pharyngeal muscles.

(Legend continued on opposite page.)

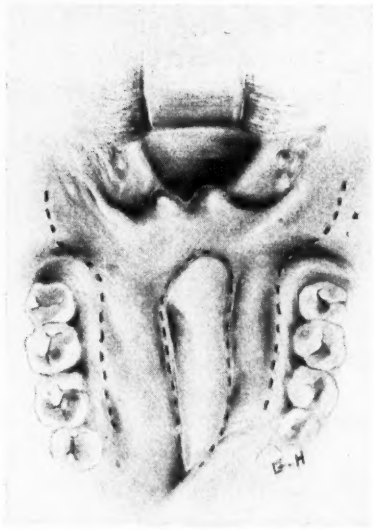

Fig. 32, *a*.

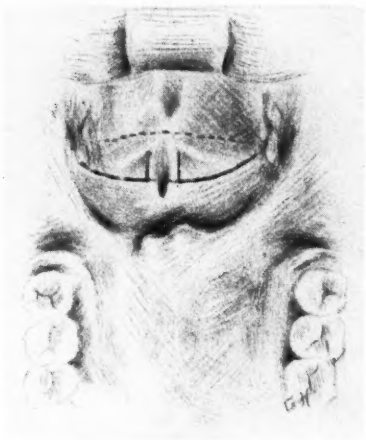

Fig. 32, *b*.

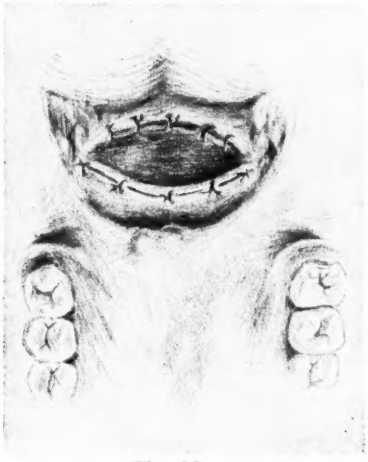

Fig. 32, *c*.

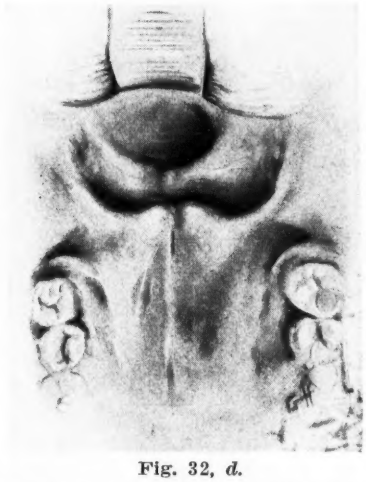

Fig. 32, *d*.

Fig. 32.—Secondary operation. *a*, The patient originally had a double cleft of the lip and palate. At operation there were 40 mm. of available flap material, about a 35 mm. space to fill in and the posterior pillars were free and well developed.

The denuding and relaxing are indicated in Fig. 31.

The second step was similar to that shown in Fig. 31, *b* and *c*, but, because we drew too freely on the pharyngeal mucosa, a constriction of the nasopharyngeal opening later developed (see Fig. 32, *b*). The very small opening between the nasopharynx and the oral pharynx was enlarged by a transverse incision through the oral mucosa at about the level of the upper pole of the tonsils. The mucous membrane was raised by dissecting it backward for a short distance and at this level cutting through the nasal mucous membrane, thus forming two flaps, one with the base below and one with the base above, the one below being composed of oral, and the one above of nasal, mucous membrane. These flaps were curled on themselves and sutured with interrupted chromic catgut so that the entire nasopharyngeal opening was surrounded with mucous membrane. In this way the opening was considerably enlarged (see Fig. 32, *c*).

d, Final result seven months following last operation.

Fig. 31 (Continued)—

b, Palate was lengthened by freeing the posterior pillars from their attachment to the pharynx almost to the upper pole of the tonsil; then the free border of each pillar was split and the median borders were united (*c*). This accomplished two things: it released the pillars so that the fauces and velum could be drawn up to the proper level, and it allowed lengthening of the velum until it practically touched the posterior wall of the pharynx (*d*).

e, The palate has been reconstructed so as to extend 3.5 cm. behind the uvula. There is an opening between the nasopharynx and oral pharynx 0.5 cm. from before backward and 1 cm. from side to side. The speech is good. He still has one opening in the upper fornix mesial of the flap that has been turned in from the cheek, and another small opening lateral of this flap in the anterior part of palate, but these seem to cause no inconvenience.

years of age[2] (see Fig. 30). In rare instances where the cleft ends anteriorly in a rounded opening bounded by the alveolus and with little or no palate process (see Fig. 16), the operation may have to be postponed for some time, and even then some modification of the classic procedure may be necessary.

In older people, especially those in whom the soft tissues have been subjected to the pressure of a dental plate which was, heretofore, retained by

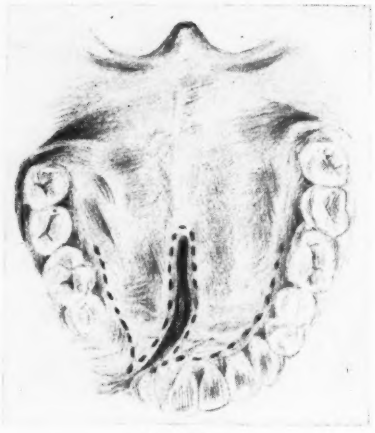

Fig. 33, *a*.

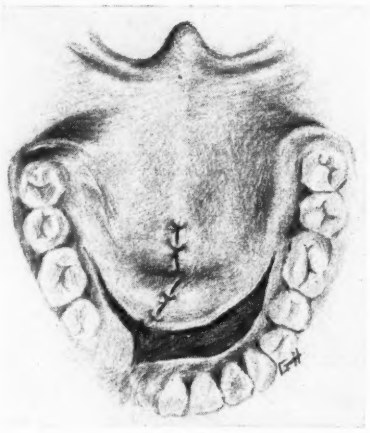

Fig. 33, *b*.

Fig. 33.—Secondary operation. *a*, Patient had had von Langenbeck operation. *a* shows horseshoe incision running around just inside the fringe, from the first molar on the left to almost the second premolar on the right. Dissected flaps back, freshened the edges of the cleft and sutured them together, leaving the anterior part of the flaps free.[6] (See Fig. 33, *b*).

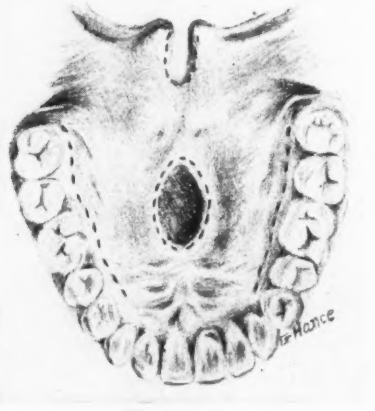

Fig. 34, *a*.

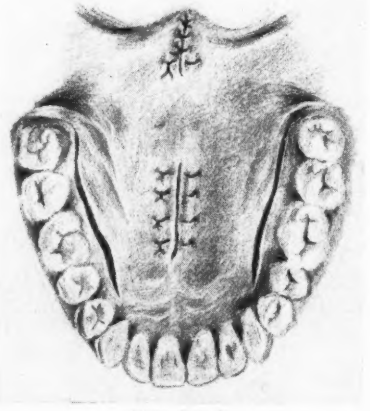

Fig. 34, *b*.

Fig. 34.—Secondary operation. *a*, Small defect in central portion of palate is closed by freely undermining through lateral incisions shown; and, if the defect is anywhere near the posterior border of the hard palate, this must be cut. The borders of the opening are then freshened and sutured as in the first operation. It is seldom necessary to close a bifid uvula, but to save nervousness on the part of the mother, it can be closed as shown in this case (Fig. 34, *b*).

tooth clasps, in palates damaged by previous operation or in extremely wide clefts, the closure can be made possible or more certain by dividing the operation into two steps, first raising and packing under the flaps, and, in a few days to two weeks, after reaction subsides, freshening the borders and suturing.[3]

One strong recommendation for the classic Dieffenbach-Warren operation is that if done without injuring the major palatine arteries and the flaps should fail to unite at the suture line, there will be little visible loss of tissue and the flaps will drop back to a normal position, without embarrassment to a properly timed subsequent attempt.

Fig. 35, *a*.

Fig. 35, *b*.

Fig. 35.—Secondary operation. *a*, In palates distorted by previous operation, one must adapt the plan to meet conditions. The right half of the uvula was united to the left border of the pillar, in this case. The dotted lines indicate the denudation slit placed slightly to the pharyngeal and nasal surface.

b, Shows the suturing of the uvula and pillars, which gave a fairly long velum. The mobilization incisions, as they scar up, will draw the new velum still farther back.

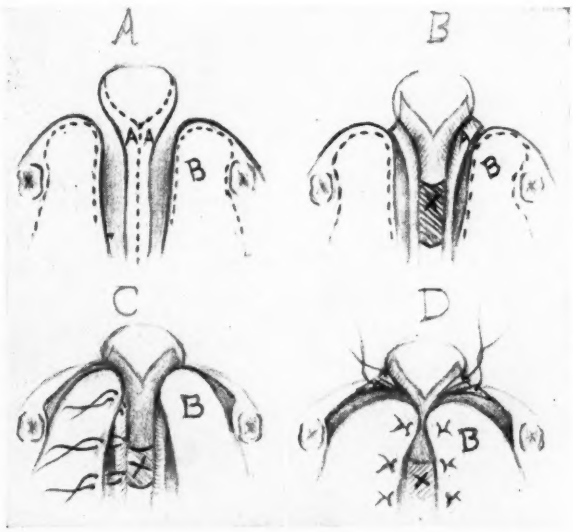

Fig. 36.—Closing the double cleft. Considerable difficulty has frequently been encountered in closing the anterior end of a wide open palate cleft. Fig. 36 illustrates the plan by which we have been able to obviate most of this difficulty. It is usually done as the second step, after the lip has been closed. The *A* flaps are raised from the septum and the sides of the sides of the premaxilla with base above. The *B* flaps are tongue-shaped with base posterior and contain the major palatine artery. After mobilizing the *A* flaps, a section is removed from the septum *X* which permits the premaxilla to move backward in contact with but not in between the maxillæ. The cleft was closed by rotating the *A* flap laterally and superimposing the *B* flap, raw surface to raw surface, and uniting the 3 mattress sutures. The premaxilla is mobilized, pushed backward, and held there by raising and uniting the mucous membrane across the face of the alveolar cleft. A year or so later the posterior part of the cleft is closed.

This article is presented not with the idea that we have anything new to offer, but, perhaps, as a timely review of underlying principles of a usable technic.

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NONSPECIFIC MEMBRANOUS STOMATITIS

LESTER RICHARD CAHN,* D.D.S., NEW YORK, N. Y.

THE following case records a condition rarely described in either dental or medical literature.

The patient was a man about sixty-five years old, who first complained of a pain in the region of the mandibular left second molar, which was acting as an abutment for a sanitary stationary bridge. He consulted his dentist who claimed that an occluded pocket hindered drainage. This was curetted without bringing relief, and the patient, noticing small ulcers on his gum, sought the advice of his physician. The latter, after making urine and blood analyses, and morphologic examination of smears, diagnosed the condition as trench mouth.

The lesions were treated daily with a dye, presumably methylene blue or gentian violet. For home use sodium perborate was prescribed, in a proprietary variety in the morning as a mouth wash and in the straight form as a paste applied to the gums in the evening. This regimen was followed for a week without much improvement. The physician then advised radiographs of the teeth, and the patient was told that pockets were maintaining the infection and that he should have them treated. It was at this time that I was consulted.

The following picture was presented. On the gum beneath the sanitary bridge and in the region of the mandibular left molar were a number of small ulcers. These had a yellow center, surrounded by a red halo. In the area of the maxillary left cuspid and the first bicuspid, at the labiogingival fold, there was a yellowish membranous patch. Palatally at this point there was some gingival irritation. Another membranous patch was present at the buccogingival fold in the molar area of the maxillary right side. The membranes were removed without much difficulty and left raw surfaces. There was no ulceration of the interdental papillae, so characteristic of fusospirillary infections. Smears made from the membranes were negative for the latter condition. Pus cells and a few cocci were seen. No pockets were found about the teeth, with the possible exception of the original one, mesial to the mandibular left second molar. Here the gum seemed to hug closely about the root, and I did not care to probe it. That the condition was not due to the Vincent conglomerate of organisms was amply proved by the clinical picture, the distinctly negative smear, and the lack of results following intensive anti-Vincent treatment.

Since the treatment that he was receiving proved to be of no avail, some modification was made. The perborate at night was dispensed with, and on his daily visit the mouth was sprayed with a very mild chromic acid solution. Occasionally the lesion was touched with a pigment.

This treatment was followed for another week with little change in the condition. The ulcers under the bridge were slightly improved, while the labial

*Associate Professor and Chairman of Division of Oral Pathology, Columbia University.

and buccal fold lesions seemed to take on a more exudative character. There appeared to be a yellowish mucouslike exudate on the surface. A smear was again made and proved to consist chiefly of pus cells and a goodly number of what morphologically would be streptococci (Fig. 1). Cultures showed almost an entire predominance of streptococci of the viridans type with a few colonies of *Staphylococcus aureus.*

About this time I found a reference[1] to a somewhat analogous condition. In the article Hiller reported five cases of a membranous pharyngitis that spread to the mouth and had oral characteristics very much like those described. A mixture of crystal violet, brilliant green, alcohol and water was suggested as almost a specific remedy. I tried an aqueous solution of brilliant green alone. In forty-eight hours the lesions had practically disappeared, and the condition was entirely cured after the second application.

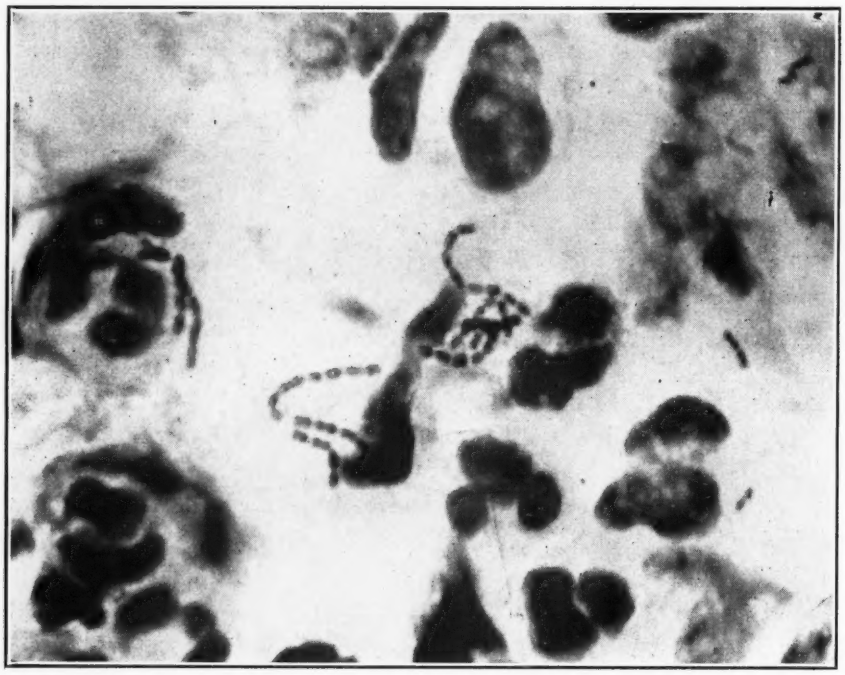

Fig. 1.—Photomicrograph of smear made from the gingivolabial fold lesion of upper left cuspid area. Note pus cells and the preponderance of streptococci.

DISCUSSION

When one mentions the descriptive adjective "membranous" in conjunction with gingivitis or stomatitis, Vincent's disease is immediately called to mind. In the case just described the physician was undoubtedly misled by the presence of a false membrane. Probably when a smear was first made, fusiform bacilli and spirochetes were present, but their presence is not particularly significant, since they are more or less common mouth inhabitants and tend to increase in number about inflamed areas. The clinical picture was certainly not pathognomonic for Vincent's disease, and the lack of quick response to anti-Vincent treatment should have made one wary. Both smears that I made were entirely different from those found in fusospirillary infections.

One might be tempted to call the condition a streptococcus stomatitis in view of the large number of these organisms found in the smear and culture, but I do not think that this designation would be correct since other bacteria, such as the staphylococcus, were also found, and the condition might well be due to a symbiosis of both these microorganisms. Furthermore, anaerobic cultures were not made, which might have shown still other types. For this reason the term nonspecific membranous stomatitis seems best.

Laryngologists have described membranous pharyngitis of nonspecific origin. Tilley,[2] in his *Diseases of the Nose and Throat,* has a small section on membranous pharyngitis (nondiphtheritic). He attributes this condition to (1) trauma, (2) microorganisms, and (3) complication of certain acute fevers. The microorganisms that he considers possible offenders are the staphylococcus, streptococcus, pneumococcus, *Bacillus coli communis,* and the Friedländer bacillus. No mention is made of the lesion spreading to the mouth.

Hiller, in the article already mentioned, gives a description similar to the condition of my patient. He says, "The membrane itself is a false membrane, moderately thin, white and opalescent and always sharply demarcated, its edges being surrounded by a thin band of hyperemia. It lifts very easily, but is followed by very free hemorrhage from the whole of the bared surface and it soon re-forms." While his cases all affected the throat, he makes distinct mention of the spread of the disease to the gingivolabial fold which was so characteristic of my case. His cultures yielded also large quantities of *Streptococcus viridans* and a few of *Staphylococcus aureus.* The brilliant green in his formula, when used alone in aqueous solution, proved to be very efficient—acting quite like a specific remedy.

SUMMARY

A case of membranous stomatitis is described. Smears made from the lesion showed a preponderance of streptococci, and cultures yielded chiefly *Streptococcus viridans* and a few colonies of *Staphylococcus aureus.* The condition had been wrongly diagnosed as trench mouth, and treatment directed toward the cure of this condition was of no value. An aqueous solution of brilliant green produced a rapid cure.

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Department of Orthodontic Abstracts and Reviews

Edited by
Dr. Egon Neustadt, New York City

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Black Ivory. By Edward Samson, L.D.S., Eng. F.C.S., 1936, London, Henry Kimpton.

White ivory—teeth without decay and without pyorrhea—are to be found only in Utopia. The only place on this earth where people are practically free from dental ills is Tristan da Cunha, a small forbidding island located in the wild seas of the South Atlantic, 1,700 miles from the Cape of Good Hope, midway between South America and South Africa. There the islanders have perfect teeth. The diet on which they live is directly opposed to that laid down by dental authorities as the most suitable to ensure good teeth. The life on this island is fraught with permanent hardships, but it produces physical perfection. It is, despite the lack of education, accompanied by a high standard of morality and complete contentment. The community and its individuals are self-supporting. It is free from disease—no rickets, no infectious diseases. They also seem to have developed an immunity to dental diseases.

All this is true despite the fact that, throughout the rest of the world, for 125,000 years, a disease has destroyed men's white enamel and has had disastrous effects upon its victims. Working stealthily, but surely, it has turned white ivory, black. In the year of 1934, there were 3,302,838 children examined in English schools; 2,273,508 required dental treatment. Their infected mouths compare sadly with their smart frocks and shoes. Commerce has met a long-felt want, but dentistry has not. The school dental service, though slowly being enlarged, is wholly inadequate; furthermore it is only reparative, it has no means of prevention or cure. For five years after leaving school the children's teeth are even worse than before, because, according to the English panel scheme, they must pay for a private dentist or their teeth must rot. Only after that time they become eligible for dental relief. Doctor J. Forbes Webster, while criticizing the teeth of Glasgow as "the worst in Great Britain," made the dramatic announcement—all too true—that "a man who would scorn to go out with his boots unpolished will walk about happily with his teeth in a horrible condition."

If caries would strike people like hydrophobia, every pathologist, every scientist would be mobilized against it, and the black plague would be stemmed. But caries kills its victims only by slow and insidious means, and therefore 90 per cent of the nation is allowed to walk about with deficient and septic dentitions. To only 14,000 dentists in Great Britain is delegated

the task of caring for 45,000,000 people. Sufficient money cannot apparently be raised to employ the necessary number of dentists. The taxpayer hears that Geneva asks for more armaments—and he pays, because of the dramatic appeal presented by the press. Dentistry has not this appeal. But still the taxpayer might be willing to pay for dental armaments if he knew that the government would not spend the money without doing something to prevent the recurrences of the dental disease, thereby eliminating the yearly recurrence of the enormous expenditures. Research workers have made valuable contributions, but altogether inadequate, because they are all working along their own lines, elaborating their own theories. A concentration of efforts through government initiative is needed. Huxley writes: "The sugar-cane of Hawaii was saved from its weevil destroyers; the destruction of North American forests by gipsy-moths was held in check; an attack is being launched upon the mealy-bugs that are such a pest to Kenya coffee, by massed battalions of lady-birds. To cope with all the demands for anti-pest organisms, a veritable industry has sprung up. There exists near Slough a Government establishment, usually nicknamed the Parasite Zoo, whose prime function is to breed up the supply of pest-parasites demanded by the British Empire. Isn't that interesting? But where is the national laboratory which is arming itself with means to fight pyorrhea? Why save our sugar crops, our wheat crops, and our cocoanut plantations? We will soon have no teeth with which to eat them. Where is the army of research workers, who, by their combined effort, are aiming to save the nation's teeth? . . . I know we have an army of such men; but what a disunited band of men they are."

This Way Salvation—if there were a National Research Laboratory, where every scrap of evidence which might throw light on the national dental problem might be carefully assayed. It would be comparatively easy to create such an institution if a similar one did not already exist: The Committee for the Investigation of Dental Disease, subsidiary of the Medical Research Council of Great Britain. This committee has been in existence for the past thirteen years but has handled the problem in a very inefficient manner, probably because its majority consists of non-dentists, and the remainder include dental research workers who are naturally influenced by their own opinions, and continue along these lines. The Black Ivory Plague continues; it is not given the same consideration, nor does it arouse public sentiment in the way cancer, smallpox and yellow fever have—probably because it is not so spectacular or so morbid. Elaborate schemes for dental treatment of the masses are supported; yet they never include an attempt at the eradication of caries and pyorrhea. That this can be done only by research is evident. Thousands of pounds sterling expended on prevention would be more effective than millions spent on repairing the symptoms of the disease. The ideal committee on the Black Ivory Plague will realize this. Above all, this ideal committee, so much interested in research work, will not contain a research worker—so that every existing theory on the causation and prevention of dental disease will be investigated without prejudice to one theory.

E. N.

International Journal of Orthodontia and Oral Surgery

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 3523-25 Pine Blvd., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 75 cents. To any place in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $7.00 per year in advance. Under foreign postage, $7.40. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, post office or express money order, payable to the publishers, The C. V. Mosby Company.

Contributions.—The editor will consider for publication original communications of merit on orthodontic and allied subjects, which must be contributed solely to this Journal. Original, double spaced, typewritten copy should be submitted.

Opinions—Neither the editor nor the publisher holds himself responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—The publishers will communicate with authors regarding reprints upon publication of papers.

Communications—Contributed articles, illustrations, letters, and all other matter pertaining to the editorial department should be addressed to the editor, Dr. H. C. Pollock, 4482 Washington Blvd., St. Louis, Mo. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, Mo.

Illustrations—Such half-tones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

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Entered at the Post Office at St. Louis, Mo., as Second Class Matter

Editorials

Preventive Medicine

IT IS estimated there are not more than 500 men trained as medical health officers and 5,000 trained public health nurses at this time. The fact that the National Security Act has moved forward its plans will no doubt require a large trained personnel in order to execute the program for the future care of the people's health.

Large universities, anticipating the future demands for this type of professional personnel, have started to train individuals in this field; and it appears that only a small beginning has been made as compared with the demands which the future holds for trained health officers. The University of Michigan reports that 126 individuals have been given the degree of Doctor of Public Health, and

at the present time 847 students are enrolled for health courses in the regular session, with a total of 1,315 including the summer session and the extension courses.

Times are changing; public health only a short time ago was limited largely to parasitic diseases and the prevention of their communication. Sanitation was the principal problem that received attention, as well as supervision of food supplies, examination of water for bacterial content, and supervised milk distribution. Now the human factor is rapidly coming to the fore; it is realized that the welfare of the individual is equally important, and this is to be given much attention by the commonwealth. Periodic systematic health examinations, protective innoculations, accident prevention, and public health education are all a part of the general plan. The education of the school child in all departments of health, including the very important but much neglected subject of oral hygiene, is receiving much more attention. It is realized that sunshine, outdoor life, exercise, and pure air are of equal and even greater significance for children than education itself. A new and important profession is rapidly in the making—the Doctor of Public Health—whose numbers will soon be great and who will take no small amount of responsibility in the administration of medical and dental service to the people.

The courses in the universities now include hygiene, bacteriology, physiology, chemistry, physical education, occupational therapy, and psychology; major activities in sports are also an essential activity in the course.

Inasmuch as the government ties in with public health in an important way, there are courses in sociology, economics, and government administration which are required in the curriculum leading to the degree of Doctor of Public Health.

After all, animal nutrition originates in the four factors of air, water, food, and light. The precipitous demand now manifesting itself for a scientifically trained personnel to understand these four simple factors and their importance to the health of the people en masse, together with the difficulty of satisfying the demand, leads to the reflection that the health professions in their praiseworthy scramble for technical dexterity and ambitious research into ways and means for the cure and prevention of disease have perhaps been oblivious to the simple fundamental factors of animal nutrition. Price in his recent contributions pertaining to the health habits of primitive peoples has done much to awaken the medical and dental professions to the importance of these simple things as related to the health of people everywhere.

—*H. C. P.*

Dr. James D. McCoy Honored

Dr. James D. McCoy of Los Angeles has been awarded the Asa V. Call trophy by the University of Southern California. Dr. McCoy was honored as the alumnus of most credit to the university during the last year. Formal presentation of the silver cup was made at the commencement exercises for 1936.

Judges selecting Dr. McCoy included George I. Cochran, Norman Chandler, Dr. Fred Olds, and Eames Bishop of the student body.

Dr. McCoy was elected president of the American Society of Orthodontists in April at St. Louis. In 1906 he was graduated from the University of Southern California, Dental Department; he is a graduate of the Angle School of Orthodontia and has headed the dental alumni association of the University of Southern California for some years. Orthodontists are proud that one of their number should enjoy the honor of having won the Call trophy of the University of Southern California, which means that the recipient has been of outstanding service to his alma mater and to the city and community in which he lives.

News and Notes

Texas State Dental Society

The Fifty-Seventh Annual Meeting of the Texas State Dental Society will be held in Dallas, August 31 to September 4, in conjunction with the Texas Centennial Exposition. Postgraduate courses will be offered in the four major branches of dentistry by twelve nationally known clinicians. For information, address Dr. J. G. Fife, secretary of the Texas State Dental Society, Medical Arts Building, Dallas, Texas.

American Society of Orthodontists

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Frank A. Delabarre, Vice-president	Boston, Mass.
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American Society of Orthodontists

The thirty-fifth annual meeting of the American Society of Orthodontists will be held in Chicago on April 26-29, 1937, inclusive, at the Edgewater Beach Hotel.

PAUL G. SPENCER, President
1817 Austin Avenue
Waco, Texas.

CLAUDE R. WOOD, Sec'y-Treas.
608 Medical Arts Building
Knoxville, Tenn.

Pacific Coast Society of Orthodontists

Northern Section

The regular spring meeting of the Northern Section of the Pacific Coast Society of Orthodontists was held at the Washington Athletic Club in Seattle on May 2, with Dr. Paul D. Lewis acting as chairman.

Following a breakfast table discussion of timely topics, Dr. Lewis reread a paper on "The Etiology of Dental Caries" which he had prepared for the Seattle Pediatric Society. Dr. Bishop and Dr. Fraser reported on the meeting of the Edward H. Angle Society of Orthodontists. Dr. Barker reported on the meeting of the American Society of Orthodontists.

The meeting then adjourned to the Olympic Hotel where several members presented clinics showing treated cases before the Washington State Dental Association.

Central Section

The Central Section of the Pacific Coast Society of Orthodontists met at the Plaza Hotel on March 10, with Dr. J. K. Diment acting as chairman. Dr. Diment appointed a Program Committee which included Dr. Winslow as Chairman and his aid, Dr. Bjornstrom, the Secretary and the Chairman being ex-officio members.

Dr. Ralph Reynolds was guest speaker and gave a most interesting talk, accompanied by slides, on the endocrine glands and their function and the relation of calcium metabolism and bone development.

Southern Section

The Southern Section of the Pacific Coast Society of Orthodontists met at the University Club in Los Angeles, on March 13, at 6:30 P.M. with Chairman A. F. Heimlich presiding.

The letter of June 20, 1935, to Dr. James McCoy from the Committee on Conduct of Orthodontic Practice regarding radio broadcasts was read. The substance of the letter was a commendation from the Committee upon Dr. McCoy's suggestion that radio broadcasts and all other public presentations on orthodontics should be made by men not in active practice in that particular locality in order that any suspicion of self-exploitation may be avoided. The action of the committee met with approval and is now an accepted precedent.

The Committee on Conduct of Orthodontic Practice presented with its approval three resolutions for the betterment of orthodontic practice. These resolutions were adopted, mimeographed, mailed to each member of the Section and being brief are appended hereto in full.

1. WHEREAS, certain important amenities are usual in the practice of a profession; and

WHEREAS, these frequently reflect the good taste, dignity, and ethics of a profession as contrasted to more commonplace commercial pursuits; and

WHEREAS, more is expected of the professional man in the conduct of his business dealings with patients than those who are engaged in purely commercial trade. Therefore be it

Resolved, That the members of our specialty make every effort to conduct their practice in accordance with the finest professional traditions, avoiding such crudities as (1) naming fees over the telephone; (2) making "follow-up" telephone calls, or sending "follow-up" letters to patients who have been in for consultation and have not yet decided to go ahead with treatment; (3) quoting to patients the supposed fees of other men; (4) examining the mouths and orthodontic mechanism of patients under the care of other practitioners, except by request; (5) or otherwise departing from methods and precepts in vogue by our more enlightened practitioners. Be it further

Resolved, That those who indulge in such practices shall be asked to sever their relationship with this organization.

2. WHEREAS, the successful practice of orthodontics requires specialized skill gained only from proper training and experience; and

WHEREAS, the care of orthodontic cases requires the personal interest and attention of the practitioners responsible for their care; and

WHEREAS, it is reported that some orthodontists are establishing branch offices which they visit occasionally and in their absence leave the responsibility of cases with general practitioners in charge of such offices; and

WHEREAS, the better type of orthodontic results cannot be achieved by this plan. Therefore be it

Resolved, That this Society condemn such procedures, and request its members to desist from such methods. Be it further

Resolved, That should any member of this organization participate in such a plan, he be requested to sever his membership.

3. WHEREAS, one of the most important professional contacts the orthodontist has with patients is that period known as the consultation; and

WHEREAS, during this period the problem of whether orthodontic treatment is necessary, or unnecessary, is determined, and in the event treatment is indicated, the most opportune time for such measures is decided, as well as the therapy to be employed, and many other things of importance in connection with the treatment and care of dental and oral anomalies, and all such information transmitted to the patient; and

WHEREAS, this service, if honestly and skillfully given, is of paramount importance to the patient. Therefore, be it

Resolved, That this organization go on record as declaring that a suitable professional fee is always justified for such service; and Be it further

Resolved, That in the future the members of this organization shall be encouraged to make a charge for such services, except in those instances in which charity is deserved or professional courtesy is to be extended to other professional men, or to those others deserving such courtesy, in which event the charge may be omitted.

Dr. Ben Reese was elected to the office of director of Pacific Coast Society of Orthodontists for a three-year directorship.

Dr. John Taylor advanced the cause of the American Society of Orthodontists and proposed that all members of the Southern Section who are eligible for the American Society of Orthodontists should immediately affiliate themselves with that organization. Dr. Heimlich recalled the meeting of the American Society of Orthodontists at St. Louis in April.

The Committee on Exhibitions at the San Diego Exposition requested assistance from the group as to the nature of the exhibits. Dr. Roberts explained the purpose of the exhibit and expressed his hope for a permanent exhibit for Southern California. Dr. Roberts moved that Dr. McCauley and Dr. Dillon proceed with the exhibit. The motion was carried.

Dr. Fred McIntosh, generously substituting for Dr. Reese, who was unable to attend the meeting, read a report of unbiased investigation by Professor Sorenson, Head of the Electrical Department of California Institute of Technology, into the relative merits, capacities, and construction principles of the Rocky Mountain and Ret. Alter Spot Welders. Dr. Sorenson's investigation resulted overwhelmingly in favor of the Alter machine.

The brief and interesting paper read by Dr. C. E. Thompson on "Dentists' Reaction to Orthodontics" revealed that many dentists are deplorably misinformed regarding the subject and that effort directed in the dissemination of information among the general practitioners would be well spent.

Montreal Twelfth Annual Fall Clinic

Arrangements for the Twelfth Annual Fall Clinic at the Mount Royal Hotel, October 14, 15, 16, under the auspices of the Montreal Dental Club, are nearing completion. A provisional program is given below.

Dr. C. H. Franzwa, New York City: "Partial Denture Construction."
Detroit Clinic Club: "Amalgam Restorations."
Dr. W. St. C. Anderson: "Metallurgy of Dental Amalgams."
Dr. F. E. Koepel: "Present Status of Dental Amalgams."
Dr. J. G. Coggan: "Manipulation and Insertion of Dental Amalgams."
Dr. Thos. E. Thompson: "Cavity Preparation and Matrix."
Dr. S. E. Riesner, New York City: "The Temporomandibular Joint."
Dr. G. C. Peck, Glens Falls, N. Y.: "Gold Inlays."
Dr. G. W. Clapp, New York City: "State Dentistry and Dental Health Insurance."
Symposium on "Oral Surgery, Anesthesia, Periodontia, and Orthodontia."
Series of Chair Clinics in local offices.

Membership reservations now being accepted by the treasurer, Dr. F. A. Edward, 910 Medical Arts Building, Montreal, Canada.

The Canadian Dental Association will this year hold its meeting in Montreal in conjunction with the Twelfth Annual Fall Clinic.